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CORN SECRETS

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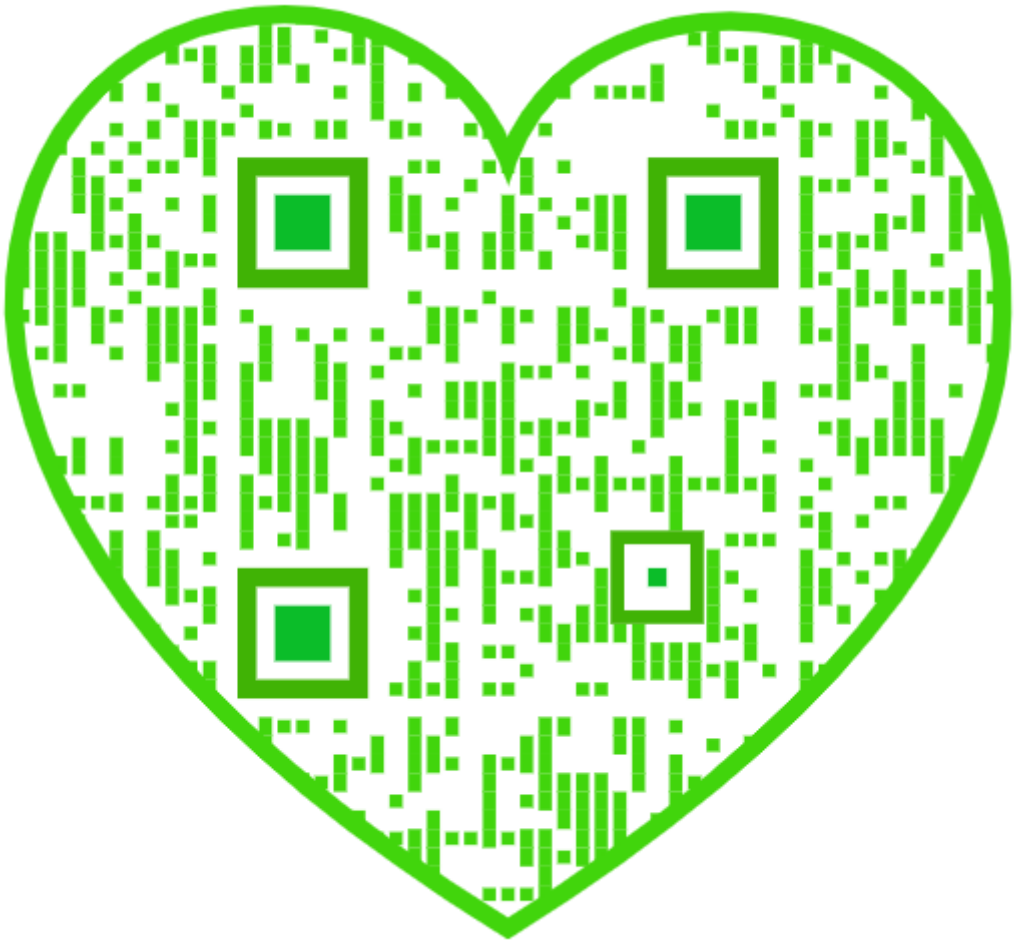

First Edition—Ten Thousand

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DEDICATION

TO EVERY CORN GROWER WHO LOVES HIS WORK AND STRIVES TO DO IT BETTER THIS YEAR THAN LAST, THIS LITTLE BOOK ON CORN IS MOST SINCERELY DEDICATED BY THE AUTHOR.

The Four Essentials

Orders for Harvesting, Testing, Grading and Improving Corn

If I owned the farms of the United States I would give four orders to my farmers as follows:

1. **Harvesting.** You must harvest during the last ten days of September and the first five days of October of this year and every year thereafter, all the seed corn intended for the next spring's planting. This seed must be strung and hung up each day, as fast as harvested, according to plans which will be explained in another place.

You will be expected to harvest and store as described, at least five times the amount of seed actually required for planting, that you may have plenty from which to select the best; and also sufficient to provide for any replanting which may be made necessary from any cause.

2. **Testing.** You must make a thorough germination test of at least six kernels from every ear selected for planting, and discard all ears that are dead or that give weak germination. You will be expected to begin this important work February 20th, and continue until it is completed, which should not be later than March 20th.

Specific directions for this work are given in another place under the head of "Preparing the Seed for the Planter" and also in "Steps in Testing Corn." You will study these directions carefully at once that you may, in due time, make the proper preparations for the work. You will be expected to follow these directions in detail as nearly as possible.

3. **Grading and Hand-Picking.** That you may secure regularity in the drop of the planter and the right number of kernels per hill (which must be not less than three), you will shell fifteen or twenty ears, each ear separately, placing the larger kerneled ears in one grade and the smaller in another. You will now test the drop of the planter with each of these grades, using the different sized plates. This is necessary to secure a uniform and proper drop. When this has been done you will proceed with the shelling, shelling each ear separately and placing it in

the grade to which it belongs. You will now *hand-pick the seed* by spreading it out on a table, a small quantity at a time, discarding the black, broken, moldy, rotten, frozen and barren kernels,—kernels which will take the place of good ones in the planter and leave vacant places in the field.

You will now place the seed in sacks, one-third to one-half bushel in each, and hang, as fast as sacks are filled, in a dry place where they will be safe from injury by mice.

4. **Improvement: The Best 100 Ears.** You must take great pains at time of harvesting and tying up the seed, and especially during the preparation of the seed for the planter, to select the *choicest* 100 *ears*, which you must shell and keep separate from the general supply of seed by providing sacks of different colors. You must plant this best seed on one side of your best and earliest planted field. It is from this seven or eight acres thus planted that you will select all the seed in September for next year's planting, as described in Order No 1. There is absolutely no excuse which shall exempt you from carrying out these four orders in good faith.

Any person who fails, will do so at the risk of having his lease discontinued at the close of the year. While these instructions may seem arbitrary and dictatorial, they are not so intended, and are given only after much thought and time have been devoted to the question of improving the corn crop. If the work is carried out as outlined, and it must be, it will result in greatly increasing the yield and improving the quality of the corn crop.

It cannot possibly result in any injury to the seed or cause loss in any way. You are in a position to perform this work thoroughly with the conveniences which you have at hand. You will also observe that this work can all be done by yourself and members of your family, and with practically no expenditure of money.

It can also be done at a time when no other work will thereby be delayed or neglected. In other words, there is everything to be gained and nothing to be lost. If this work is fairly well done it will increase the yield on our farms from the present average of thirty-four bushels per acre to forty-four bushels. One additional fourteen ounce ear of corn to each hill will make forty-four bushels per acre. It is not only possible to do this, but the yield can eventually be raised to fifty-four bushels per acre. The average township grows about 66,000 bushels of corn worth

approximately $33,000. In the average county with 100,000 acres, we would have 1,000,000 bushels increase over the present yield, and valued at $500,000. The corn crop of the United States in 1910 amounted to over 3,000,000,000 bushels. If my four rules of seed selection had been practiced it would have increased that yield by 900,000,000 bushels, and that at a very small cost in dollars above the expenditure required to produce the lesser yield.

Three Things That You Must Not Do:

1. You must not import seed corn from a distance with which to plant the general crop. If, however, it becomes necessary for any reason to purchase seed corn to plant, you must secure the same from some reliable person in your vicinity. You may, if you so desire, import a small quantity for the purpose of comparison.

2. You must not follow oats with corn. This rule will be put in force after the present year when you shall have had time to make the necessary readjustments.

3. You must not continue on your farm without establishing a definite system of rotation. This rotation shall include clover or clover and timothy, and corn must not be grown more than two years in succession on the same land.

In the following chapters complete instructions, with explanations and illustrations, are given for carrying out these orders.

The Ten Steps

Or the Secret of Preparing Seed Corn for the Planter

Fig. 1. **First Step.**—Lay the ears side by side on the tables or planks arranged for that purpose, where they can be studied and compared and the poorer ones discarded.

Fig. 1

Fig. 2. **Second Step.** Discarding the Poorer Ears.—When the table has been filled go over the ears and discard the poorer ones, i. e., those which by

Fig. 2

general appearance show immaturity, weak constitution, or are chaffy, moldy, etc. This process must be repeated by adding new ears until the table is again full of ears which, judging from outside appearance, are good.

Fig. 3. **Third Step.** Examining the Kernels.—From each of these selected ears remove two or three kernels, and place them, germ side up, at the end of the ear from which they were taken. Make a more careful study

Fig 3

of both the kernels and the ears, pulling back to be discarded those ears which have faulty kernels, i. e., ears whose kernels are too small, too shallow or are immature, starchy or moldy, or that have small, weak, or frozen germs, etc. Do not neglect this step.

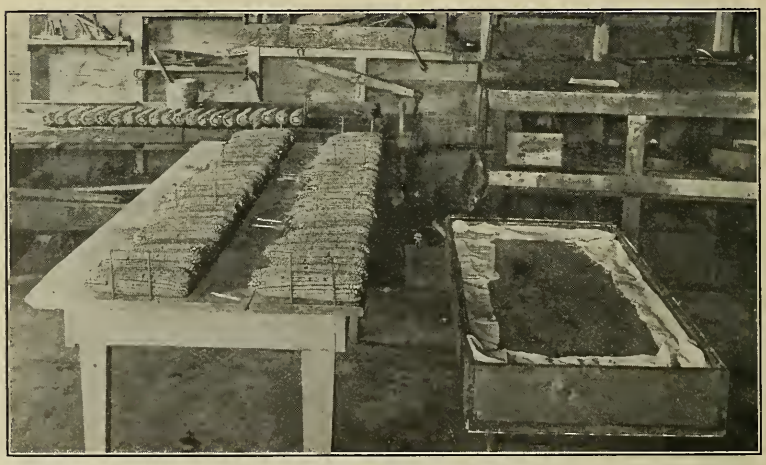


Fig. 4

Fig. 4. **Fourth Step.** Making the Germination Test.—After the poorer ears have been discarded, as shown in the previous cut, the ears are arranged as shown above; the nails separating them into ten-ear divisions. Each tenth ear is numbered 1, 11, 21, etc. Six kernels are taken from each ear, beginning with No. 1, and placed in the germination box, shown at the right of the table,

to sprout. In another place the process of making a germination box and putting the corn over to test will be shown more fully.

Fig. 5. **Fifth Step.** Butting and Tipping the Ears.—When the corn has been tested and the weak and dead ears have been discarded the small, irregular tip kernels and the large butt kernels should be shelled off, mainly because

Fig. 5

they will not drop evenly from the planter. In case there is more seed than can be tested at one time, it will be advisable to put a second set over to germinate while the first lot is being butted, tipped, shelled, etc.

Fig. 6

Fig. 6. **Sixth Step.** Shelling Ears One at a Time.—Shell each ear separately, catching the corn in a basin or box. This makes it possible to grade the corn as to size and quality of kernels. The young man at the right is examining the corn from an ear. If the kernels are large, he will put them in one of

the boxes marked "large size." If clean, bright, and of good quality they will go into a box marked "first grade"; if not so good they will go into a box marked "second grade." If the kernels are rather small they will go in a like manner into a box marked "small size." In case an ear when shelled shows a large number of broken, moldy or rotten kennels, or is inferior in quality in other ways, the corn is emptied into a dish marked "discarded." Plant grade No. 1 first and use only what is necessary of the second grade to finish with. The larger planter plates should be used for the larger grade and the smaller plates for the smaller grade.

The importance of shelling each ear separately cannot be too strongly emphasized.

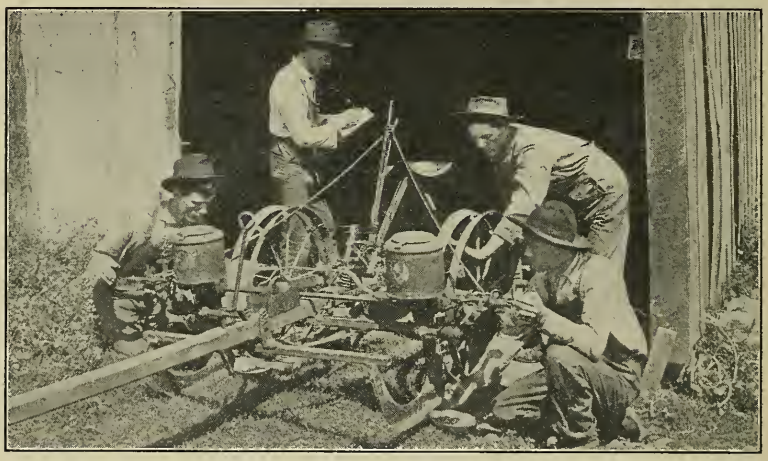


Fig. 7

Fig. 7. **Seventh Step.** Testing the Planter.—After shelling fifteen or twenty ears and grading them as described in the former steps, the two grades should be taken to the planter and tested with the different plates. If the test shows that one or both of the grades are not suited to the plates, another fifteen or twenty ears should be shelled and the grades readjusted by putting more of the corn into the large grade, or the reverse. In like manner test these grades in the planter. You will now be in a position to shell the remainder of the seed and grade it intelligently. Testing the planter, as described, will require not to exceed two hours' work. The right amount of seed and an even drop are essential to the largest yield. This is especially true where the corn is mostly checked and the crop is grown for the ears and not for the fodder. DON'T GUESS, *know* that the planter drops your seed properly.

Fig. 8. **Eighth Step.** Getting Rid of the Chaff and Irregular Kernels.—While not generally done, it is a good plan to put one-third to one-half of a bushel of shelled corn in a box at a time and tread it with the feet for two or three minutes to rub off the chaff and projecting tips of the kernels. Chaff gathers under the planter plates and around the trip and frequently greatly interferes with the dropping. There is often a little sharp projection at the tip of the kernels, especially if the seed was picked early or is slightly immature, which interferes with the regularity of the drop unless rubbed or broken off as described above. The corn should now be run through the fanning mill to blow out the chaff, or, better still, run through the little hand sorter as shown in Fig. 8½. This will not only take out the chaff but will also remove the small, inferior kernels and the large, irregular ones, such as "nigger heads" which are caused by imperfect pollenization of the corn and are found more or less in every ear. Running the seed through the hand sorter greatly lessens the work

of "hand-picking" described in the next step. A bushel of corn can be run through the hand sorter in five minutes.

Fig. 8

Fig. 8½

Fig. 9. **Ninth Step.** Picking Out the Bad Kernels.—Spread the corn on a table, a small quantity at a time, and pick out the black, broken, barren, moldy, rotten kernels which would take the place of good ones in the planter, leaving vacant places in the field where there should

Fig. 9

have been good stalks and good hills. This work is often done evenings when the boys and girls are home from school. The corn being spread out on the

kitchen or dining-room table, it will require but an hour or so to go over a bushel of seed corn in this way, depending somewhat on the quality. If you have never run over your seed, hand-picking it as described above, you will have very little conception of the number of defective kernels you will find in a bushel. Try it this coming spring, you can't possibly lose. It will increase your profits this year and improve the corn for the future.

Fig. 10. **Tenth Step.** Hanging up the Seed One-half Bushel in Each Sack.—When the seed has been tested, graded for the planter, hand-picked, etc., as described, it should be put in sacks containing not more than one-half bushel each, and *hung* up in a *dry* place *free* from mice. There is probably no better place than in the attic, where the strings of seed corn were hung during the winter. (See fig. 7, p. 26.)

Fig. 10

Special attention is called to the three sacks hanging at the left labeled "*seed from the best* 100 *ears.*" This *best* seed was put in flour or sugar sacks to distinguish it from the general supply of seed which was put in grain or gunny sacks. At planting time, take down this *best* seed, put it in the planter and plant it on one side of the field. Finish the field from the general supply of seed. In the fall go into the seven or eight acres planted from this *best* 100 *ears* and gather the seed for next year's planting.

There is no law more certain than this that "like begets like." You ask how you are to secure those *best* 100 *ears?* While you are preparing the seed for the planter, i. e., sorting, testing, shelling, etc., keep watch for any unusually good ears. These should be laid to one side until all of the seed corn has been gone over. Then shell, hand-pick and hang up, in different-colored or different-sized sacks to distinguish them from the regular supply of corn seed.

The Secret of These Ten Steps Lies in Three Facts.—First: That we cannot possibly lose and we are certain to increase our profits, not only this year but every year. Second: That it costs almost nothing except a little attention, thought and work at the right time. Third: That every one can do this work himself and at a time when no other farm work will be neglected.

The Secret of Testing

Six Kernels Taken from Each Ear of Corn Intended for Planting

"Mother Earth may offer her choicest fields, the sun may lavish his brightest rays, the gentle showers may float down on the balmiest winds of spring to nourish the infant plant—yet, if this child of God has been touched by the blighting breath of decay, or is the offspring of perverted parentage, all the kindly care of loving Nature, aided by the hand of man, but emphasizes the more strongly that 'Whatsoever a man soweth, that shall he also reap.'"—From Farmers' Tribune.

Making the Test.—There are several excellent Seed Corn Testers on the market. Probably no method is better suited to all conditions than what is known as the Sawdust Germination Box method, which is briefly described as follows:—

Getting Ready.—Make a box three to four inches deep and 30x30 inches in dimensions. Fill the box about half full of moist sawdust well pressed down so as to leave a smooth, even surface. The sawdust should be put in a gunny sack and set in a tub of warm water for at least an hour (or still better over night) so that it will be thoroughly moistened before using. Rule off a piece of good white cloth (sheeting) about the size of the box, into squares, checkerboard fashion, two and one-half inches each way. Number the squares, 1, 2, 3, etc. Place the cloth on the sawdust and tack it to the box at the corners and edges. Lay out the ears to be tested side by side on planks, tables, or on the floor, as shown in fig. 7; remove one kernel from near the butt, middle, and tip of the ear; turn the ear over and remove three kernels from the opposite side in like manner, making six kernels in all, thus securing a sample from the entire ear. Place the six kernels at the end of the ear from which they are taken. Use care that the kernels do not get mixed with those from the ear next to it. After the kernels are removed, boards may be laid over the rows of ears to keep them in place until the result of the germination is known. Place the kernels from the ear of corn No. 1 in square No. 1 of the germination box; from ear No. 2 in square No. 2, and so on with all the ears. Lay a piece of good cloth on top of the kernels and dampen it by sprinkling water over it. Then place over this a cloth considerably larger than the box and fill in on top of this about two inches of moist sawdust and pack it down firmly by treading with the feet. The edges of the cover may be folded over the sawdust in the box to prevent drying out. The box is now ready to set away until the kernels sprout. Keep in an ordinarily warm place like the living-room where it will not freeze. The kernels will germinate in about eight days.

Remove the cover carefully to avoid misplacing the kernels in the squares. Examine the kernels in each square in the germination box, and discard all ears whose kernels in the box are dead or show weak germination.

Special Things to be Observed.—Be sure to soak the sawdust at least one hour—or better still over night.

Use *good* quality of cloth (sheeting) for the cloth that is marked off in squares and the cloth which is laid over the kernels.

Leave at least two inches margin around the edges of the box to prevent freezing and drying out.

Rule the cloth off in large squares $2\frac{1}{2}$x$2\frac{1}{2}$ inches.

Never use the box the second time without first thoroughly scalding both the cloths and sawdust. (The cloth should be untacked and the sawdust removed to do this.)

Do not open too soon. The stem sprouts should be at least *two* inches long.

Throw out all ears showing weak germination as well as the dead ears.

Advantages of the Sawdust Germination Box.—1. It costs nothing but a little time and labor.

2. It furnishes nearly natural or normal conditions.

3. The sawdust is light, clean and easy to get and handle in February and the first of March, when the testing should be done; is a good non-conductor of heat and cold, so that the temperature is kept even during germination, and holds the moisture so perfectly that there is no danger of drying out.

The number of boxes required will depend upon the amount of seed to be tested and the time limit. Where several boxes are used, we generally stack them up, one on top of the other.

When the first set of boxes has been taken off, it is a good plan to put another set over at once, and while the corn in these is sprouting, the first set of ears can be butted and tipped, shelled, graded and hand-picked. If more than one kernel of the six fail to grow, the ear should be discarded. If only one kernel fails to grow, the ear should generally be discarded; unless it is an especially good ear in other respects, when it might be well to give it another trial in the next test.

Ears whose kernels mold badly in the germination box should be discarded. If the kernels show weak, spindling sprouts, or a part of them are very weak and uneven, the ear should be thrown out to make place for an ear whose kernels give strong, vigorous sprouts. Remember that the kernels which are slow to sprout and are weak will be behind the strong ones in the field, and being shaded by them will give us weak, runty stalks with small ears.

Poor seed means a poor stand, with missing hills; one-stalk hills with weak stalks, producing little or nothing, also wasted land and wasted labor; it means less than thirty bushels of corn per acre instead of fifty or sixty; it means that we produce on an average in each hill just one small ear of corn weighing less than ten ounces.

The following illustrations will show thoroughly every step in making this test:

Fig. 1 Fig. 2

Fig. 1.—Putting the gunny sack of sawdust over to soak in warm water.
Fig. 2.—Pushing the sack of sawdust down into the water to insure thorough soaking.

Fig. 3.—Seed left to soak for at least one-half hour (better over night), when it should be removed from the water which has become cold and put into warm or hot water. It is always best to have the sawdust warm when put into the box, ready for the corn to be put over.

Sawdust can always be obtained from the ice house, sawmill, lumber yard or meat market.

Fig. 3

Fig. 4

Fig. 4.—Take the sack out of the tub and tread it to remove the excess of water, so that it will not be too cold and soggy for the corn and to prevent the water from running out of the box after the corn is placed therein.

Fig. 5

Fig. 6

Fig. 5.—Put two inches of this sawdust in the box and pack it down so that it is smooth and firm. It is now ready for the germination cloth. This box is 30x30x4 inches deep and will test 100 ears.

Fig. 6.—Place the germination cloth, which has been ruled off in squares, on the sawdust in the box and tack to the edges sufficiently to hold in place. Notice that there is a two and one-half inch margin around the edge of the box.

Fig. 7.—Ears laid out ready for making the germination test. A spike is driven after every tenth ear. Every tenth ear is numbered, as shown, with a piece of chalk. Six kernels are now taken from different places in ear No. 1

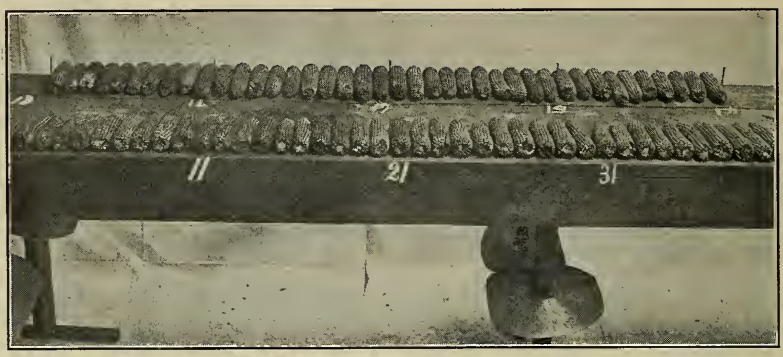


Fig. 7

and placed in square No. 1 on the cloth in the germination box, as shown in the next cut. This process is repeated with ears Nos. 2, 3, 4, etc., until all of the ears have been put over to test.

Fig. 8.—Arranging the kernels in the squares. The kernels are laid on their backs with germ side up, the tips toward the left and the crowns toward the right or top of the box. *Remember* that the crowns of the kernels are all *one way*, in this case toward the right.

Fig. 8

Fig. 9

Fig. 9.—Putting on the cover cloth. As soon as this is laid over the kernels, sprinkle a few handfuls of warm water over it to fit it down tight over them. It is now ready for the larger cloth, on top of which is to be put two inches of sawdust.

Fig. 10.—This cloth is larger than the box. On top of this fill in with about two inches of the warm sawdust and pack down firmly, as shown in next cut.

Fig. 10

Fig. 11

Fig. 11.—Packing the sawdust down firmly over the corn. The edges of this top cloth may now be folded in over the sawdust to prevent evaporation.

Fig.12

Fig. 13

Fig. 12.—Folding the cloth in from the edges over the sawdust.
Fig. 13.—The crowns of the kernels are toward the right side of the box

which is being raised by placing under it a four-inch brick. When the kernels sprout, the stems which come from the crown end of the kernels will grow toward the upper side of the box, and the roots which come from the tips of the kernels will grow down toward the lower side. The advantage of this will be apparent after you have had experience with testing.

Fig. 14.—Set away for the corn to sprout. Frequently five or six boxes will be put over at the same time and set on top of each other.

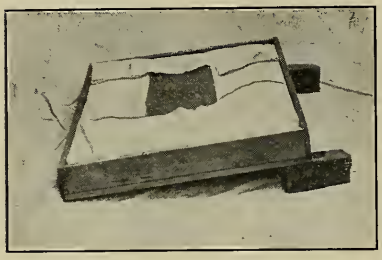


Fig. 14

Fig. 15

Fig. 16

Fig. 15.—Rolling off the top cloth with the sawdust.

Fig. 16.—Peel back the cover cloth carefully so as not to disturb the

Fig 17

kernels. The kernels have only started to sprout and the box must be recovered and left until the sprouts are two inches long, as shown in fig. 18.

Fig. 17.—At the end of eight days the box is uncovered and carefully studied. The tester has pulled back ears Nos. 3, 8, 13, 18, 23, etc., and is now pulling back ear No. 17. This is to show that some or all of the kernels in the germination box from these ears were either dead or weak. These ears will be discarded.

Fig. 18.—Ears Nos. 2, 6, 9 and 11 should be discarded. Ears Nos. 3, 5, 8 and 10 are strong. *Save* out ears like these for the *best* 100 *ears* provided they are good in other respects. Ears may have life as in the case of No. 6, but when these kernels fall into the hills with others, like Nos. 3 or 5, they are deprived

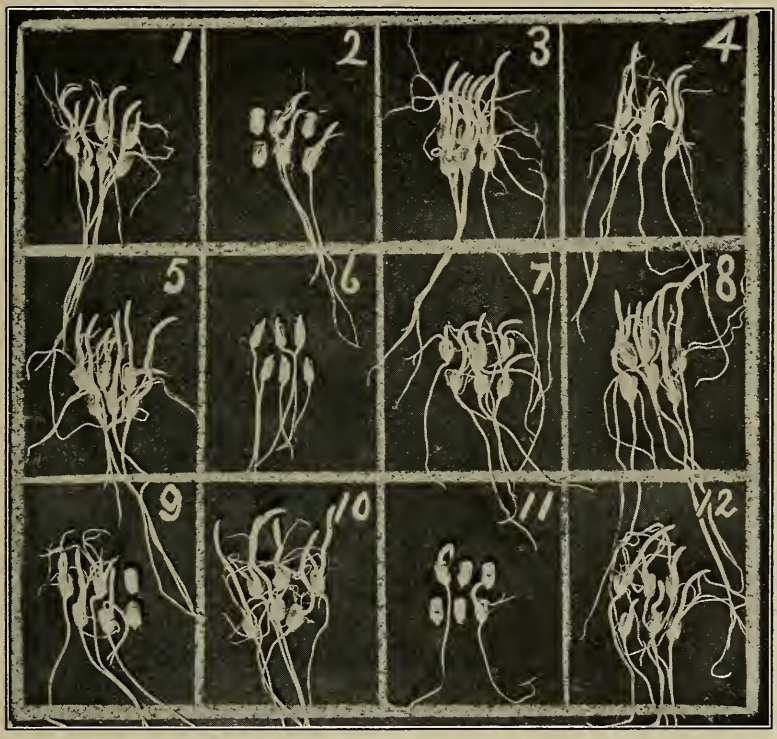


Fig. 18. Showing sprouts in the germinating test at the end of eight days.

of food and light and give us stalks with little or no grain, but they produce pollen to scatter over the field to propagate their kind. Ear No. 6 is one of the kind that fools us, when we attempt to judge by the eye and the jack-knife method. Ear No. 6 was planted by the side of ear No. 3 but yielded less than half the corn in the fall.

If we buy the germination boxes and the cloth and hire the work done it will not cost to exceed sixteen cents per acre to test every ear for seed.

Fig. 19. Rows From Separate Ears.—Test each ear of seed before planting time and discard the dead ones. Don't GUESS but TEST.

Each row in this field was planted from a different ear of corn. The row on the left on which the man is standing is fine; the row on which the other man is standing is good; but the middle row, or the one between them, is almost worthless. The testers "GUESSED IT WOULD GROW."

Fig. 20. Rows From Different Ears of Corn. Another "Guess" That the Ears Were All Right.—The right row has a perfect stand of corn, the left row is nearly worthless, the middle row has only about half a stand.

Fig. 19

Fig. 21. Rows From Separate Ears of Seed.—The right-hand row is scarcely waist high, while the left-hand row is shoulder high, almost completely

Fig. 20

hiding the man standing in the row. A germination test would have revealed the weakness of the seed ear from which the right hand row was planted.

Fig. 22. Two Hills of Corn.—The left hill is from the left row in the previous cut (fig. 21) and the right hill is from the right row. Note the healthy, vigorous appearance of the stalks in the left hill as compared with those in the right.

Fig. 21

Fig. 23. A Hill of Corn.—These stalks both grew in the same hill but were separated a few inches in photographing. This right-hand stalk has 800 brothers and sisters scattered throughout the field which came from the same

Fig. 22

Fig. 23

ear of seed as did this one. The kernels from some ears of corn produce a large proportion of weak stalks.

Fig. 24. Two Stalks From a Hill Separated for Photographing.—The two kernels from which these stalks grew were dropped side by side in the same hill at the same instant.

Why this difference at laying-by time? This weak stalk had a poor start and never recovered. The larger one shaded it and stole the moisture and nourishment because of its more extensive roots.

Fig. 24

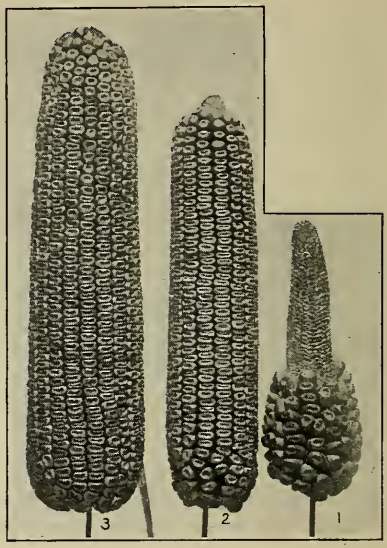


Fig. 25

Fig. 25. These Three Ears Grew in the Same Hill.—Why is ear No. 1 so much smaller than ear No. 3? Difference in soil? No. Cultivation? No. Depth of planting? No. It can be due to none of these reasons, for all three kernels were dropped at the same time, at the same depth, and being in the same hill had exactly the same care. What then is the cause? It is due to the difference in parents. The three kernels from which these three ears came were taken from three different ears. The kernel which produced ear No. 1 was weak. Remember that this nubbin has 800 sister ears scattered here and there throughout the field. This means not only 800 nubbiny stalks this year but 800 nubbin stalks have been perpetuated, i. e., projected into the future, by distributing tens of millions of grains of pollen over the field to fertilize the silks. You haven't any of this kind? Try it and see. Plant this spring say fifty of what appears to be your choicest ears *each ear* in a *separate row side by side*. Watch them through the summer and harvest each separately in the fall.

Testing each ear will do more to get rid of the nubbin producing ears than any and all other things put together. The weak nubbiny stalks were weak when the kernels first sprouted and "once a runt, always a runt." If they are behind at the start they are at a constant disadvantage from being shaded and deprived of food by the stronger ones.

Gathering the Seed

The Secret of Harvesting and Storing Seed Corn

Fig. 1. Harvesting the Seed Corn for Next Year's Planting.—Every ear of corn intended for planting should be harvested before the severe fall freezes, and stored where it will dry out and keep dry. In Iowa and the northern half of Illinois this work should be done the last ten days of September and the first four or five days of October. Frozen seed corn costs the country millions of dollars every year.

A Convenient Method of Gathering the Seed as One Passes Between the Rows.—Use an ordinary two bushel grain sack; a wooden hoop from a nail keg is put in the top of the sack. Some heavy cord, fourteen inches long (binding twine doubled several times) is tied to one of the bottom corners of the sack; the other end of the cord is then brought over the shoulder and tied to the hoop in the top of the sack. The cord is wrapped with an old sack to prevent the string cutting the shoulder.

Fig. 1

Fig. 2. Tying up the Seed Corn. Putting in the First Ear.—A piece of binding twine is doubled and the ends tied together. Note how the string is held in the hands.

Fig. 3. Putting in the Second Ear.—Notice that the left hand is run through between the two strands of binding twine held in the right hand. The hands

Fig. 2

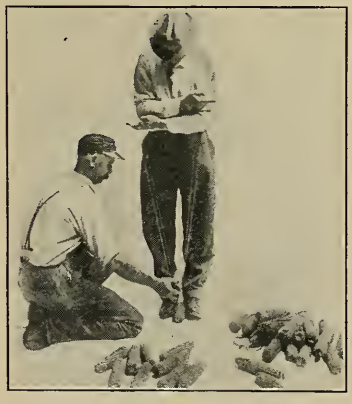


Fig. 3

are now brought back and the man standing is ready for the third ear, fifth ear, etc., as shown in the next figure.

Fig. 4.—The left hand is again run through the strings in the right hand, and reversed.

Fig. 5. Showing the String of Corn Completed Ready to be Hung up Where it will Dry Out and Keep Dry.—When the last ear is laid in, one end of the string is slipped under the string in the other hand, and fastened.

Fig. 6. Commencing on the Second String.—Tie and hang up the seed the same day or evening that it is brought in. This method of tying up allows a

free circulation of air. It is *circulation* of air, not heat that is needed to dry out the seed. Corn commonly contains at this time from thirty to forty-five per cent. of water. It requires but a few minutes to tie up 300 or 400 ears.

Fig. 4

Fig. 5

Don't leave them on the porch for the chickens to get at, or in a pile where they will mold or freeze before they are dry. TIE and HANG up at once.

Fig. 7.—Experiments show that the attic or some up-stairs room where the windows can be opened to give circulation of air during October and November, is the best place to hang seed corn. A space 3x8 feet will hold 200 strings of seed corn like the above or enough to plant 200 acres. Discard three-fourths of it in the spring and there is left sufficient to

Fig. 6

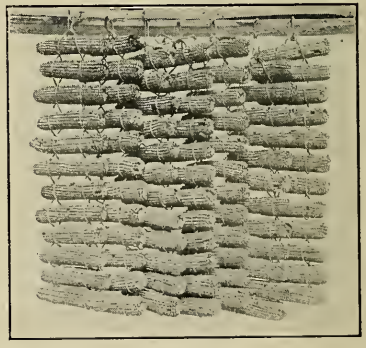


Fig. 7

plant fifty acres, or more than the average acreage on each farm. Hang the strings in rows four inches apart each way.

Secret of Corn Cultivation

The Selection and Preparation of the Soil and Planting

It will be understood by everyone that methods will vary greatly with different climates and different soils. There are no iron-clad rules which can be followed blindly in the growing of corn.

Frequently two very different methods may give similar results. However, there are certain principles which will apply under all conditions.

It should be the motto of every corn grower to *have good ground, to do* his work *on time* and to do it *thoroughly.*

The Secret of Good Soil.—What is needed is more clover, a better use of barnyard manure and a rotation of crops which shall include clover.

Nothing can make up for poor ground. Too many are trying to grow corn on worn-out land that has produced corn and oats for years. A man at an institute in Illinois said in all seriousness that he was satisfied that the seasons were less favorable for growing corn than they used to be, as he could get no such crops as he formerly raised. It developed that he had grown corn for seventeen years in succession on the same piece of ground. No wonder "the seasons were becoming less favorable."

The fact is that the time is near at hand when we must pay greater attention to the fertility of our soil, to the conserving and restoring of the elements of plant food, or we shall soon be compelled to pay out millions of dollars each year for these elements in the form of commercial fertilizers.

The tremendous importance attached to this question of plant food cannot be appreciated by those who have had no experience in using commercial fertilizers.

The Secret of Fall Plowing for Corn.—There is a great diversity of opinion regarding the merits of fall and spring plowing, even in the same neighborhood. Among the advantages of fall plowing may be named the following:

1. The work can be done at the dullest time of the year when both men and teams would otherwise be idle.

2. Having the ground already plowed in the spring gives us time better to prepare the soil, and, what is of equally great importance, to *get our corn in on time.*

3. Better preparation and a warmer seed bed insure a better stand of corn.

4. Fall plowing lessens the danger from insect injuries, especially in the case of sod ground.

5. Weeds are prevented from seeding, and the seeds already in the ground will mostly germinate and be killed by the fall freezes before seeding. This is especially true of early fall plowing.

Some of the disadvantages of fall plowing are:

1. Occasional losses from blowing and washing.

2. Unless the ground plowed in the fall is disced early in the spring there is loss of moisture and a consequent "firing" of the corn during the latter part of July and August, especially in dry seasons.

3. Fall plowing does not give as good an opportunity to spread manure during the late summer and through the winter.

Recently the Soils Department of the Iowa State College conducted experiments with fall and spring plowing in different parts of the state, and in

every case the yield of corn was greater on the fall than on the spring plowed land. The evidence is generally in favor of fall plowing in the corn belt.

Fall Plowing Often Neglected.—The mistake is commonly made of leaving the fall-plowed ground without discing until time to plant. By spring the ground has become packed by snows and rains and should be disced or at least harrowed as soon as oat seeding is over. This will conserve the moisture and prevent the "firing" of the corn in August, that so often follows fall plowing.

Ground that is very rolling and likely to wash should not be plowed in the fall. Early fall plowing is generally advisable where the stubble ground is very weedy.

Where the area put into corn is large, and the corn planting period is short, it is the best kind of management to fall plow all stubble and sod ground.

It may sometimes be advisable to leave some ground for spreading manure on during the winter. In this case it had better be the clover sod than timothy or bluegrass.

Where clover is seeded with the oats or barley for fertilizing purposes, or where rape is sown in the oats for fall feed, it will, of course, be necessary to plow late in the fall.

The Secret of Early Spring Discing.—The fall-plowed ground is generally neglected in the spring and left to dry out, while the weeds get a good start, robbing the ground of moisture and food. Not only should the fall-plowed ground be disced as soon as the oat seeding is over, but the corn-stalk ground as well. When corn-stalk ground is disced early in the spring, the moisture is saved, the stubs and stalks are cut up and mixed with the soil, and as a consequence are less bother during the cultivation, and a better seed bed is secured. If not disced, the surface is turned to the bottom of the furrow in a lumpy condition, where neither the harrow, disc nor cultivator can reach it.

Better Treatment of Spring Plowing.—We often abuse our spring-plowed land by turning up the furrows to the sun and dry winds to bake and dry out, depending on a shower to mellow the ground at planting time. It is a good rule never to leave the field either at noon or at night without first harrowing the ground that has been plowed.

There is seldom any advantage in plowing more than six inches deep either in spring or fall. If ground is to be plowed deeper than formerly it should be done in the fall. On heavy soils the bad effects of too deep plowing is often apparent for several years.

Secret of Early Planting.—We should bear in mind that one of the most serious losses each year to the corn crop is due to late planting. The experiments show that late planted corn seldom yields as much as the earlier planted, and the quality is inferior. The ground becomes hard and out of condition, the weeds have drawn upon the moisture and available plant food, the corn comes to the dry spell in August at a more critical stage, and it matures slowly, contains more water and is much more likely to be caught by frost.

Many Plant Too Deep.—Too deep planting is especially bad when the seed is weak, and the spring cold and backward. When the ground is not well prepared, or is very mellow, there is danger of putting the seed down four or five inches, when two inches would be better. Especial care should be taken in early planting when the ground is still cold.

Where the same seed was planted in two different fields, giving a good

stand in one case and a very poor stand in the other, investigation showed that the poor stand was due to deep planting. Corn is generally planted deeper than we think. The planter wheels frequently sink into the ground two or more inches and the corn is covered another two inches. The planter tracks are then filled by harrowing, and the corn is often more than four inches deep. We usually watch the depth carefully for a few rounds when we start the planter and then pay no more attention to it. The soil is generally mellower as we get away from the head land, and consequently the corn is planted deeper than we supposed. The following illustrations show the results of deep and shallow planting:

Fig. 1. Kernels Planted One, Two, Four, Six and Eight Inches Deep.—Not only do many kernels fail to grow when planted too deep, but those that come up are weaker, often producing no ears.

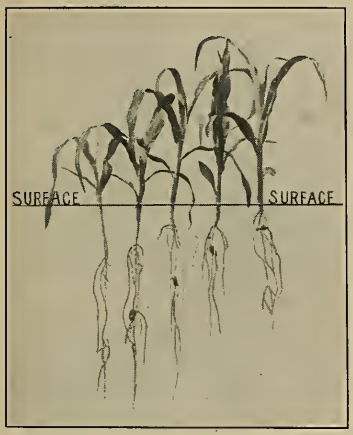


Fig. 1

Fig. 2

Fig. 2. Effect of Deep and Shallow Planting. (*a*) planted two inches deep; (*b*) planted six inches deep.—Many are careless in planting and get the seed too deep. This is especially bad when the ground is cold and wet. Even when the ground is warm, the results are not so good as when the seed is put two to two and one-half inches deep. Twenty kernels of strong seed were planted on warm, sandy soil June 30th. Ten of the kernels were planted two inches deep (*a*) and ten were planted six inches deep (*b*). All ten kernels of the two-inch planting came up quickly and gave strong plants, as shown in the illustration. Only four of the ten kernels planted six inches deep came up and they were several days later appearing. The other six kernels sprouted but could not push their way to the surface, the sprouts doubling back as shown at (*c*).

The Secret of Straight Rows and Even Checking.—The yield of corn is often reduced and the work of cultivation made difficult and slow, because of carelessness in handling the planter. Uneven checking may be due to several causes. In the case of short fields we generally draw the wire too tight and the planter checks too quick both ways. On long fields we are apt to check ahead owing to the slack in the wire, and this is especially true where the tongue of the planter is raised too high and the team is fast.

In the case of irregular shaped fields, the checking is frequently bad. This is especially true where the ends of the field are not at right angles with the rows. In this case there will be a jog every four rows, depending on how much the field is out of square.

Carelessness in setting the anchor is the cause of much poor checking. It is a common practice to draw the wire to about a certain tightness at both ends of the field. It is a much better plan always to draw the anchor back at one end of the field to a definite line indicated by stakes, while at the other end it should simply be drawn until the wire has a certain tightness.

The Secret of Keeping Ground in Good Condition.—Many think that there is nothing to do for two weeks after the corn is planted or until it is up and large enough for the first cultivation. There are others who believe in harrowing, and even in cultivation before the corn is up, but on account of the pressure of work neglect it. Where ground is left untouched for two weeks and often longer, it becomes fouled with weeds, which take up moisture and plant food and make it difficult to work the corn. The ground is packed by the rains and baked by the sun, until it becomes hard and dry, and out of condition.

It is especially important in the growing of corn that it be not stunted when young, as it never fully recovers even under the most favorable conditions.

We should keep a good, mellow, lively tilth until the corn shades the ground, and prevents the rain and sun from beating upon it, and making it hard and dry.

The time to kill weeds is before they come up and before they have deprived the corn of moisture and nourishment.

The Secret of Blind Cultivation.—Where it is possible to do so it is a good plan to cultivate the corn once before it comes up, following the marks made by the planter wheels. This is known as "blind cultivation." The cultivator shovels should be set so as to throw the dirt slightly away from the row. It is generally best to follow with the harrow in the same direction within two or three days. If the field is small so that the cultivation can be finished before the corn breaks through the surface, it is well enough to wait until the field is all cultivated, and then cross it with the harrow instead of following close behind the cultivator. However, in the case of large fields, it is best to follow the cultivator with the harrow.

It is a common practice with some to harrow corn after it is up, but I prefer to cultivate and harrow as described above, and especially on corn-stalk ground where the old stubs catch more or less in the teeth. Even on oat stubble ground the harrow does considerable damage to the young corn. No one can afford to do less than to thoroughly loosen the ground before the corn comes up. It is a serious mistake to let our corn ground once get out of condition in the spring.

The Secret of Shallow Cultivation at "Laying by" Time.—It is also a very common mistake to cultivate shallow when the corn is small and lay it by with a deep cultivation. The reverse would be more profitable. There is little danger to the roots from the first deep cultivation, and there is a great advantage in going deep enough to secure a good mulch.

The succeeding cultivations should be no deeper than is necessary to keep the ground clean. "Many cultivate corn as though the roots went straight down" instead of spreading out through the surface of the soil. It is very essential that we disturb the roots as little as possible when the corn is "laid by." We are very apt to feel that as this is our last chance at the corn, we

must give it a deep cultivation, especially if the weeds have gotten a start. This is a mistake. Cultivation should be level and frequent. It may be deep at first but must be shallow later.

Fig. 3.—"Many cultivate corn as though the roots went straight."

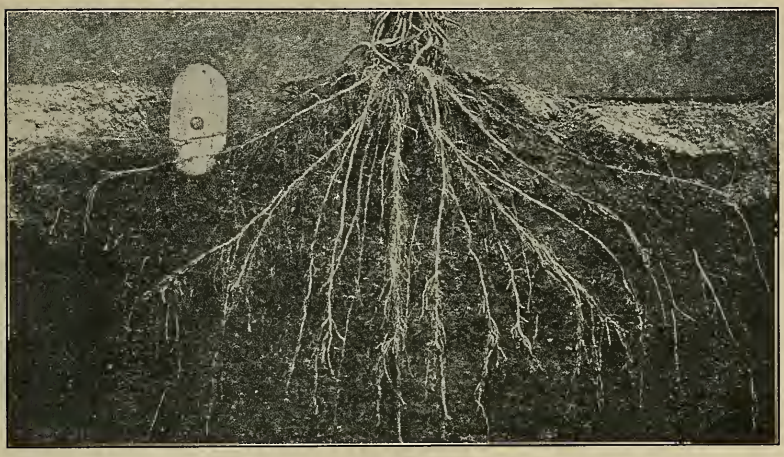


Fig. 3

Fig. 4.—Four hills of corn at earing time, in natural position in the field, three feet eight inches apart. The surface soil was washed off as deep as the ground was plowed in the spring, exposing the roots. Few realize how com-

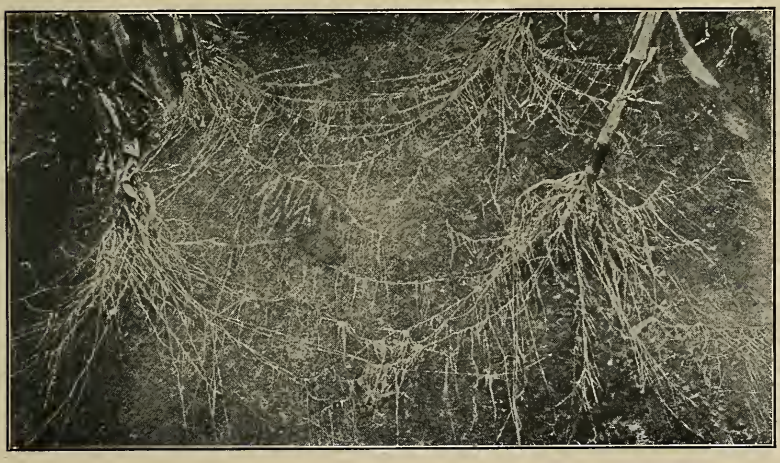


Fig 4

pletely the ground is filled with the corn roots. Thorough early cultivation before the roots have developed is important. Experiments show that deep cultivation at the time of "laying by" greatly reduces the yield, especially when the first and second cultivation were shallow, thus allowing the roots to come near the surface. (Photograph by Prof. A. D. Showel.)

Corn Enemies

Their Methods of Attack. How to Detect and Destroy Them

The enemies of corn may be classed under three heads, as follows:

1. Insects such as corn-root worm, corn-root aphis or louse, cutworms, wireworms, white-grubs, corn bill bugs, sod web-worms, seed corn maggot, ear-worm, grain-moth, weevil, etc.

2. Animals, such as gophers, squirrels and moles. Birds.

3. Fungous diseases, such as corn-smut, maize rust, leaf-blight, dry mold, rot, etc. Only those enemies which cause the greatest losses and which can be either entirely or partially prevented will be discussed here.

The Northern Corn-Root Worm.—The damage done by the northern corn-root worm is enormous. The remedy is simple, complete and inexpensive. Let me plead with every farmer to make a careful study of this, the most serious of the enemies of corn. This little white enemy is so very small and does its work under the ground in the roots of the corn, unobserved, and does it so gradually, that few people have any knowledge of the insect or of the tremendous damage it inflicts upon the corn crop every year. During the past ten years I have made careful study of the work of this insect, examining thousands of corn-fields throughout the corn belt, and I have been constantly surprised at the enormous losses which it causes, and yet, with three exceptions, I have never found a man who knew what ailed his corn until he was shown. One example will serve as an illustration of what has happened scores of times in my examination of corn-fields. During the latter part of July, Professor Mosher and I were securing specimens from a field (see fig. 1). The renter came over to see what we were doing, and it is needless to say that he was greatly surprised when we showed him the 465 worms which we had taken from the roots and surrounding dirt of one single hill of corn. The field did not yield to exceed fifteen or twenty bushels per acre of very poor quality corn, and he was obliged to give half of this as rent.

Next to "bad seed" the northern corn-root worm is the greatest source of loss to the corn belt. It certainly does more damage than all the other corn insects put together.

Habits.—The eggs are laid mostly during August and September and hatch in the following June and the first part of July. The worm is white and when full grown is about one-third of an inch in length and as large around as a pin. As soon as hatched, the worm enters the roots of the corn, and burrows back and forth, lengthwise, through the root, just under the outside covering. Sometimes five or six worms will be found in one root. Frequently 200 or 300 will be found in a single hill. The roots thus affected turn brown and finally die and rot off, leaving short stubs. The stalk is thus deprived of moisture and nourishment, and after a rain, when the ground is soft and a heavy wind prevails, often goes down badly, particularly in those places most affected.

Generally the little white worm will have reached its full size by the latter part of July and the first of August, when it pupates and in a few days comes out as a small beetle, light or yellowish green in color at first, but soon turning to a grass-green. It distributes itself throughout the field and migrates to others, feeding on the silks, and the corn at the tips of the ears, especially

where the husks have been broken open and the corn injured by the birds, ear-worms, etc.

There are two very significant facts which should be known by every farmer.

1. The worm subsists almost entirely upon the roots of corn, sorghum being the only exception which has come under my personal observation. It refuses to eat the roots of oats, wheat, grass or clover.

2. The beetles always lay their eggs in the corn-field, never in a meadow pasture, or oat-field. The eggs are deposited in the ground near the hills of corn.

Many hundred fields of corn have been examined, but in no case did I find any damage from the northern corn-root worm, where corn followed some other crop, as pasture, clover, oats, wheat, etc. The second crop of corn was damaged considerably, except in a few sections where corn is not the principal crop. But where corn has been grown more than two years on the same ground, consecutively, the damage was always serious, and in many cases the yield was reduced to fifteen or twenty bushels to the acre, and this, too, in some instances where the ground had been manured in the winter, before the plowing in the spring.

Indications of Its Work. The indications are, 1.—The falling down of the corn during the latter part of July and August, especially in the spot most affected and after a rain followed by a wind; later the stalks will curve upward, giving them a sled-runner or rainbow appearance.

2. The corn will have an uneven growth, certain patches being especially poor and making a slow advance during the latter part of June and first part of July. The plants will also have a yellow or sickly appearance and seem to stand still.

3. The presence of the worm itself, which can be determined by pulling up a hill of corn and breaking open the roots.

4. The appearance of the roots. When one root has been destroyed, the worm attacks another. Often every principal root and the brace roots are completely destroyed, while in fields not so badly affected only a portion of the roots are destroyed; others will have a dark appearance and, when split open, will show the burrows of the worms, although the worm may have left the root some time before.

5. Ease with which the stalks may be lifted out of the ground, even with one hand. It will require considerable effort to pull up a healthy hill of corn with both hands. Often the stalks fall flat upon the ground and die.

6. The firing of the corn during the dry weather of July and August.

7. The large number of stalks in the field with no ears or with very poor ones.

8. The presence in the corn-field, especially in the silks at the tips of the ears, during August and September, of a large number of small green beetles, about twice as large as the head of a pin. They are most numerous during August, although they may be seen as late as October in late planted fields.

9. The corn is often retarded in growth and matures late and is often injured by frost as a consequence. Where the corn falls down badly, it rots before husking time.

10. The corn in the ear is light and chaffy and often moldy.

Remedy.—The remedy is rotation of crops, never growing more than two crops of corn continuously on the same ground. If the corn went down considerably in August, especially in spots, if the stalks can be pulled up readily and the roots are badly rotted off, if there are many barren stalks or stalks with poor ears, and if the field has been in corn two years consecutively, it should go into some other crop for at least one year, or better still, seeded down and left one or two years in clover.

The Aphis or Corn-root Louse.—Next to the root worm, the corn-root louse causes probably more loss each year to the corn crop than any other insect pest. The lice are smaller than the head of a pin, blue-green in color and appear in clusters on the roots of the corn. They are always found associated with ants, which act as guardians, protecting them and carrying them to the roots of the corn. The lice pierce the root covering with their sharp beaks and suck the juices which should go to build up the plant. When disturbed by the ants they exude a sweetish substance called "honey dew" from their two honey tubes, and upon this the ants feed.

The root louse does its greatest damage on old, badly worn fields, especially if they have been in corn for several years. It is generally worse on low, damp ground, because of the fact that the ants transfer the lice to the roots of the smartweed and foxtail during the latter part of the season when the corn roots have become hard and woody.

It is difficult to keep the low, wet places free from weeds, and hence they become the breeding places of the root lice and ants.

The greatest damage is done when the corn is small. The lice often attack the root as soon as the corn sprouts and kill it before it comes up. The plant generally lives, however, but makes a slow, feeble growth. The indications of lice are:

1. The presence of ants in the field with ant holes in the hills of corn, often made before the corn is up.

2. A slow growth of the corn in spots through the field, when it is small, the corn having a sickly, yellow appearance. Where the lice are particularly bad, the corn will have a purple tinge, toward the tips of the leaves, and the stems or stalks will have a reddish color.

3. The corn is so held back that it matures late in the fall, often being caught by the frost.

4. The yield is greatly reduced and the quality of the corn is poor.

Remedy.—The remedies are: 1. Rotation of crops. 2. Clean cultivation in low places. 3. Harrowing or cultivating the ground before the corn comes up and again while the plant is small. This hinders the ants in transferring the lice and their eggs to the roots and also stimulates the corn to more rapid growth. 4. Manuring the ground. This gives a vigorous growth and enables the corn better to withstand the drain caused by the lice.

Successfully Combating Insect Pests.—Every one is familiar with the work of the corn-ear worm, sometimes also called the cotton-boll worm, tobacco-bud worm, etc. This worm is found distributed throughout the United States. Its greatest damage has been done in the South, where it works on corn, cotton, tobacco, beans and other plants. The damage has been unusually great during the past year throughout the corn belt. The worm is especially fond of sweet corn and frequently injures it to such an extent that the canning

factories are obliged to shut down. There are from three to five broods each year. They pass the winter in the ground in the pupa stage, and come out in the spring as moths to lay their eggs. The first brood eats the leaves of corn and other plants, the second brood eats the corn silk and tassels, and the third brood eats into the end of the ears of corn and works back and forth. The actual damage done by the ear-worm itself is not so great as the injury resulting from other insects, and from mold, rot, etc., which follow up the work of the worm. There is no known remedy which is successful. In the South it is claimed that fall plowing of the badly infested corn ground exposes the pupa to the freezing weather, killing many of them.

Fig. 1

Fig. 2

Fig. 1. Work of the Northern Corn-root Worm.—This field has been in corn continuously for several years. The corn-root worm probably causes more loss to the corn belt every year than all other insects put together. Remedy: Do not put more than two successive crops of corn on the same ground.

Fig. 2.—The owner of this field did not know why his corn went down so badly. He ought to have forty-five bushels per acre, but he will not get to exceed fifteen to twenty and it will be chaffy and light. The corn-root worm is responsible for the difference.

Fig. 3.—The stalks when attacked by the corn-root worm frequently fall down flat on the ground and die. There were thousands of them in this field August 12th. There were thousands of others whose roots have been injured so that they will not produce ears, and thousands of others will bear nothing but nubbins.

Fig. 3

Fig. 4.—Average stalks from two different fields. The left one is from a field in corn for the third or fourth consecutive time where the corn-root worm had become well established. The right one from a first sod field. Notice the difference in the condition of the root system on these two stalks. Nearly

every root on the left has been destroyed by the corn-root worm. It was pulled up with no effort, while it required a great deal of effort to pull the other stalk whose roots had not been injured.

Fig. 5.—The left stalk from second year corn. The right stalk from field five or six years in corn. The roots are completely eaten away by the root worm.

Fig. 4

Fig. 5

Fig. 6.—The original root system was destroyed by the root worm and the stalk blew over the latter part of July. It is doing its best to recover. The brace roots have taken hold again and are supplying some food to the stalk which is trying to regain an erect position.

Fig. 6

Fig. 7

Fig. 7.—These roots were split through the center lengthwise with a knife. (*a*) shows end of root completely destroyed so that it is a mere stub and dead. By examining carefully it will be seen that the worms worked just under the outer covering of the root until they came to the tip when they bored into the

middle, destroying it. (*b*) shows a healthy root to the point of (*c*) where it was eaten off. To make up for this loss a mass of roots have been developed above (*c*) to help nourish the plant.

Fig. 8.—A corn root split lengthwise exposing a small white worm at the point (*a*) which can be seen by examining the illustration carefully. This is the corn-root worm.

Fig 8

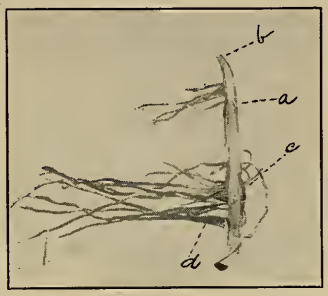


Fig. 9

Fig. 10

Fig. 9.—Root split open exposing worms at (*a*) and (*c*). The root is completely eaten off at (*b*); (*d*) rootlets sent out to help repair the damage.

Fig. 10.—Root split open showing worms at (*a*), (*b*) and (*c*) just under the outer covering of the root.

The worms are hard to see as they are white like the fibre of the root itself; small, being one-half or one-quarter inches in length, not larger around than a needle, and sluggish in movement.

When the worms have bored around and around the root, girdling it, the roots turn brown and the outside comes off easily when disturbed.

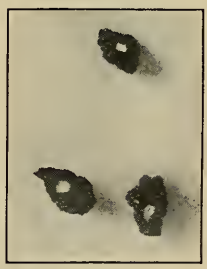


Fig. 11

Fig. 11.—Corn-root Worm Pupating.—During July and the first part of August when the worm has completed its growth, it comes out of the roots and in some way forms a little lump of dirt around itself as large as the end of the little finger. The illustration shows three of these lumps of dirt broken open exposing the little white worm which, in a few days, will have changed into a beetle about the size of a cucumber beetle or of a small grain of wheat. It then comes out of the ground and in a day or so will change from white to yellow and then to green, when it will be found feeding on the silks of the ears and the pollen of the tassels.

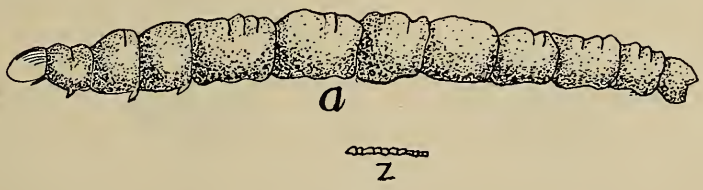


Fig. 12

Fig. 12. Different Stages in the Growth of the Corn-root Worm.—(*a*) shows larva or worm enlarged nine times; (*z*) shows actual size. This is about

as it looks during the last part of June and the first part of July when it is three-fourths grown and doing the greatest damage by eating back and forth just under the outer covering of the root, and frequently eating through the center of the root. (*b*) full-grown worm which has crawled out of the root into the earth and is ready to pupate, i. e., change into a beetle. (*c*) thickened up and in the first stages of pupating. (*d*) (see also fig. 11 just preceding this cut) shows the pupa more advanced in its little pocket or lump of earth. One edge or side of the lump of earth has been broken off exposing the pupa.

Fig. 12

Fig. 12

Fig. 12

Fig. 13.—(*e*) pupa developing wings; it will soon come out as a beetle; (*x*) actual size; (*f*) the beetle enlarged ten times; (*y*) actual size. In the

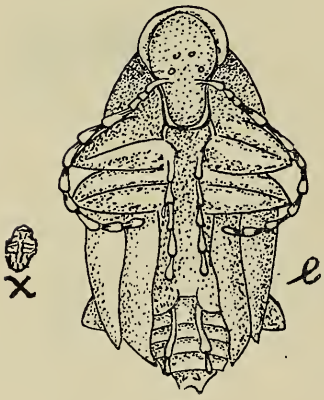


Fig. 13

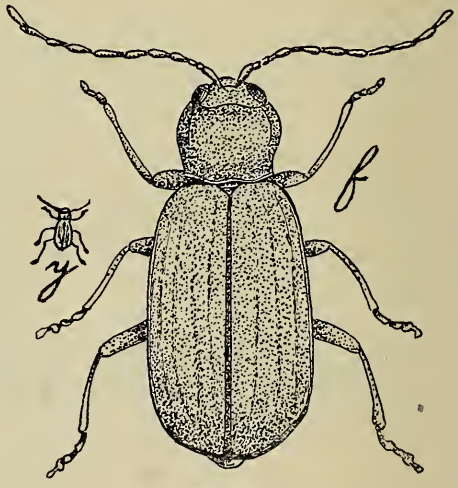


Fig. 13

corn belt the beetles begin to appear the last of July, varying considerably with the season and latitude. During August and September they are to be found by the thousands in the corn-fields and especially in those that have

been in corn two or three or more years continuously. As many as sixty-five or seventy have been found in the silks of a single ear. They are also found in great numbers on thistle and sunflower blossoms near affected fields.

Fig. 14.—Roots split open lengthwise showing the work of the root worm. (*a*) healthy root not damaged; (*b*) and (*c*) show how the worm works just under the cover of the roots. The roots soon die and rot off. (*d*) the worm usually works through the middle of the roots, especially the young tender roots and the ends of the older roots which are also tender. (*w*), (*x*) and (*y*), worm at work exposed by splitting open the roots.

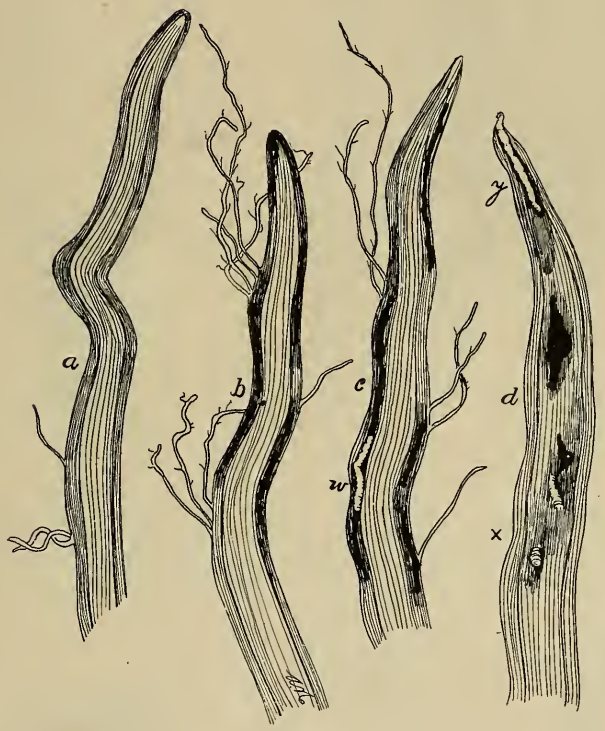


Fig. 14

Fig. 15. The Corn Worm Does its Work Unobserved.—(*a*) a healthy root; (*b*) shows path of the worm through the root; the end of this root was eaten off. (*f*) shows the outer covering of the injured root peeling off; (*d*) and (*e*) show the root worm at work. It is not an uncommon thing to find 200 of these worms in a single hill of corn. Recently 465 were dug from one hill. The root worm, like the white plague, does its work so quietly and unobserved that we are not aware of its terrible ravages.

Fig. 16. Southern Corn-root Worm.—The southern corn-root worm does not lay its eggs in the fall as in the case of the northern corn-root worm beetle, but lives through the winter and lays its eggs in the corn-field after

the corn has come up. The worm works in exactly the same way as the northern corn-root worm. The beetle is yellow with twelve black spots and is about twice the size of the northern corn-root beetle.

It does considerable damage in the southern part of the corn belt (Kentucky, Tennessee, Missouri, Kansas and some damage in Southern Ohio, Indiana and Illinois), as it waits until spring when the corn is up to lay its eggs so that it cannot be headed off by rotation of crops as in the case of the northern corn-root worm.

The total damage, however, to the corn belt from the southern corn-root worm is small as compared with that of the northern corn-root worm.

Fig. 15

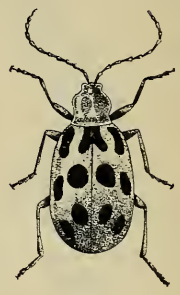


Fig. 16

Fig. 17. The Corn-root Louse, or Aphis, and its Guardian the Ant.—There are several generations during the summer. After the first generation some of the lice may have wings. (*a*) and (*b*) are females, the spring and summer generations, producing their young alive; (*e*) egg; (*x*) honey tubes;

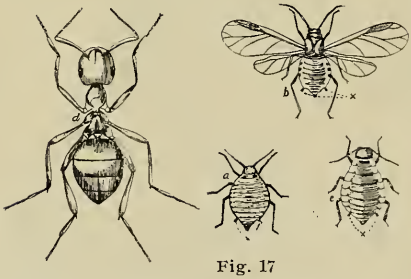


Fig. 17

Fig. 18

(*d*) the ant which cares for the egg and lice and in turn receives a portion of its food from the lice; (*c*) females of the late summer and autumn generations which lay eggs that hatch early the following spring.

Fig. 18.—The ants carry the lice to the roots of the corn. The early spring generation of lice are helpless, depending for existence on the care given them by the ants.

Fig. 19. Corn Ear-Worm.—An ear of sweet corn with the husks stripped back showing the ear-worm and its work.

Fig. 19

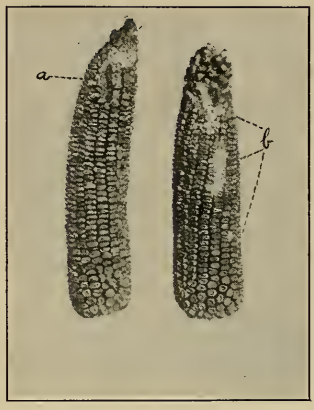


Fig. 20

Fig. 20.—Another view of the ear-worm and its work. (*a*) worm at work; (*b*) places eaten out by the worm.

Judging Corn

Points to be Considered in Corn Contests

If both the exhibitor and the judge at a corn show will bear in mind a few fundamental facts about corn and corn shows, there will be fewer misunderstandings and mistakes and greater progress.

The best ear of corn is that ear which will, when planted, give the greatest profits per acre year after year. The *best ear* of corn for seed is also the *best ear* for the show. The judge should place the blue ribbon on that ear or on that sample of corn which he would select to plant year after year on his own farm, if he lived in the district from which the exhibits are made.

In picking out his samples for the show the exhibitor should lay his ears out side by side on tables or planks where he can study and compare them.

Judging Corn a Difficult Task. Judging corn is not merely a matter of picking out the samples which look best, etc. Perhaps there is no line of judging work which is so difficult or requires such intimate knowledge of conditions.

Let me illustrate. Suppose that the judge at the state show judges and places ribbons on a class of corn which was labeled southern district of the state, but later finds that it was wrongly labeled and it was in reality from the northern district; will his placings be right for the northern district? No. The sample he has placed first in the southern district, and perhaps rightly too, might be almost a total failure in the northern district. The work of the judge is made all the more difficult from the fact that the classes often include different varieties and a wide range of territory and climate.

The judge should bear in mind that there is no one best type of corn for all localities and conditions. The real question in the mind of the judge should be, Is this sample or that sample the one which is best, i. e., the one which will give the greatest profits to the majority of the people in the district under their conditions of soil, climate, drainage, methods of growing, etc.?

The Importance of Right Placing. The judge should realize the importance of right placing or judging of the samples. If the people in the vicinity have confidence in the judge, there will be dozens and sometimes hundreds who will purchase seed of the prize winner, and still others who will buy of the person who bought of the winner. I know of communities and sections of a state which have lost thousands and tens of thousands of dollars simply because the judge placed the blue ribbon on corn entirely unsuited to their soil and climate. On the other hand, I could give instances where the decision of the judge brought into prominence types of corn that have not merely made many thousands of dollars but millions for the people.

Four Questions. There are four fundamental questions which the exhibitor must ask himself in selecting his corn for the show or for seed. These are the four questions which the judge must also ask himself in placing the corn:

1. Will it yield, will it produce, has it constitution, vigor, hardiness? Among the things which go to indicate good yield are size, shape, solidity and weight of ear, depth of kernel, size of germ, fullness of tip, of kernel, etc.

2. Will it mature; i. e., ripen, not only this year, but every year in the region or district in which it is grown or entered for show? Immaturity will

be indicated by too large an ear, too deep a kernel, sappiness, chaffiness, dull, starchy appearance, etc.

3. Will it grow; i. e., will it germinate, giving strong, vigorous plants which will stand unfavorable conditions in the spring and summer?

Indications of good vitality are a clear, clean, bright, smooth, horny kernel with a large chit or heart. It is a good indication to find a white brittle germ when the kernel is opened with the knife. It is a bad sign to find a germ pasty or cheesy in appearance or of a yellow or dark color. Ears that are chaffy, starchy or of a dull appearance are questionable, depending largely on the method of harvesting and storing.

The exhibitor can settle the third question as to whether or not it will germinate strongly, by testing six or eight kernels from each ear in advance of the show. When possible to do so the judge should test the corn at the show before awarding the premium, as has been done recently at the larger shows.

4. Does it show improvement? Has it years of careful selection or breeding back of it? Has it been mixed with brains so that it will reproduce uniformly in type, in time of maturity, in size and shape of both ears and kernels?

The judge will be successful in proportion to his ability to see in the samples of corn before him just what they will actually produce in profit the next year and the next year, and so on, when grown by the people of the district from which the entries are made.

Secrets of the Score Card. What is the score card? The score card is a concise statement of the points and their relative value, to be considered in selecting the best ear or the best group of ears.

The reason for having such a statement of details is not to furnish a mechanical method of judging corn, but rather to *assist* the grower in selecting his seed, the judge in placing the samples and the student in his study of corn.

The purposes, then, of the score card are: 1. To aid the corn grower, the judge and the student in keeping in mind the fundamental things to be considered in selecting the most profitable ear or set of ears, with respect to yield, maturity, improvement and growing quality.

2. To prevent the laying of too much stress on one or more of these points to the exclusion of others.

3. To prevent the giving of undue importance to some merely trivial points, such as the filling of tips, straightness of rows, etc.

4. To secure uniformity in methods of judging and studying corn so that there will be a clearer knowledge of what is good corn, and a better understanding between the exhibitor and the judge.

Finally, the ultimate purpose of the score card is better corn; that is greater profits from each acre and for each day's labor put on that acre. The score card should not be followed blindly, or even mechanically, but intelligently, or it will do more harm than good. After all, the judge or the person selecting his seed is the principal factor, and upon his knowledge and experience must depend the final decision as to whether this sample or that, whether this ear or that shall be selected for planting or be awarded first place. The score card can never take the place of knowledge and experience.

The beginner will necessarily confine himself rather closely to the score card until he has become thoroughly familiar with all of the things which go to make up a good ear and a bad one, as well.

Corn Score Card

Name of Scorer_____ Place_____

Number of Sample_____ Date_____

I. WILL IT YIELD? 25 POINTS.

That is, will it yield well; has it constitution; can we depend on it even when conditions are unfavorable?

		Perf. Score	† 1	2	3	4	5	6	7	8	9	10
I	Will it Yield?	25										
*	Size of Ear ‡ 6											
	Solidity or Heaviness 4											
	Depth of Kernels 3											
	Cheerfulness 3											
	Size of Germs 2											
	Fullness of Middle 2											
	Filling of Butts 1											
	Filling of Tips 1											
	Space at Cob 1											
	Furrows Between Rows 1											
	Size and Condition of Cob 1											

II. WILL IT RIPEN? 25 POINTS.

That is, will it mature; will it ripen every year; is it safe for the locality?

		Perf. Score	1	2	3	4	5	6	7	8	9	10
II	Will it Ripen?	25										
	Size of Ear 6											
	Depth of Kernels 4											
	Sappiness 3											
	Chaffiness 3											
	Starchiness 3											
	Size of Cob 2											
	Plumpness of Tips of Kernels 2											
	Adherence of Chaff to Tip Caps of Kernels 1											
	Adherence of Tip Caps to Cob 1											

*Under the head of "*Will it Yield?*" are given several points such as Size of Ear, Solidity, Depth of Kernels, etc. These are simply *indications* that it will or will not yield well. In a like manner under the other headings "*Will it Ripen?*" "*Will it Grow?*" etc., are a number of indications.

† The figures 1, 2, 3 to 10 at the top of the page refer to the different samples being judged. No. 1 may be Mr. Smith's sample, No. 2 Mr. Brown's, No. 3 Mr. Jones', etc.

‡ The figures 6, 4, 3, 3, 2, etc., are to indicate the relative importance of the different points or "indications."

Fig. 1

III. WILL IT GROW? 25 POINTS.

That is, has it vitality; will it germinate; will it all grow and grow uniformly, giving strong, vigorous plants?

		Perf. Score	1	2	3	4	5	6	7	8	9	10
III	Will it Grow?	25										
	Color and Condition of Germ and Embryo 10											
	Sappiness 3											
	Chaffiness 3											
	Starchiness 2											
	Moldiness of Cob 1											
	Plumpness of Tips of Kernels 1											
	Size of Germs 1											
	Smoothness of back of Kernels 1											
	Smoothness of Germs 1											
	Adherence of Chaff to Tip Caps 1											
	Adherence of Tip Caps to Cob 1											

IV. DOES IT SHOW IMPROVEMENT. 25 POINTS.

That is, has it breeding; has it a distinct type; will it reproduce itself; has it several years of careful selection and improvement back of it?

		Perf. Score	1	2	3	4	5	6	7	8	9	10
IV	Does it Show Improvement?	25										
	Purity of Color of Grain and Cob 10											
	Shape of Ear 3											
	Shape of Kernels 3											
	Uniformity in Size and Shape of Ear 3											
	Uniformity in Size and Shape of Kernels 3											
	Character of Dent 2											
	Straightness and Arrangement of Rows 1											
		Perf. Score	1	2	3	4	5	6	7	8	9	10
	Total Score	100										
	Rank of Ear											

Fig. 2

Fig. 3

Will it yield	=25—24
" " ripen	=25—16
" " grow	=25—24
Does it show improvement	=25—20
Total score	84

Fig. 4

Class A
Entry No. 10
Place 3d

Figs. 3 and 4. Entry Tag, 1¼x2 inches.—One side of the entry tag should have printed upon it the four main points of the score card.

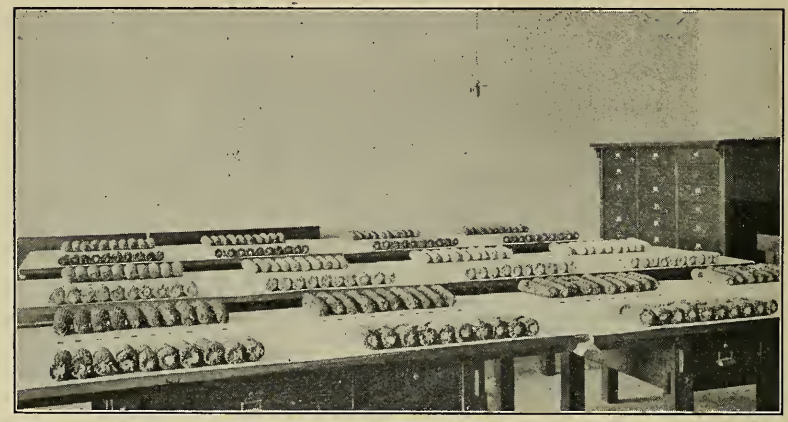


Fig. 5

The other side should contain the entry number, etc. The most convenient way to fasten the tag to the ear is by means of a rubber band slipped through the eye of the tag and around the ear.

Fig. 6

Fig. 5.—Samples of corn arranged ready for judging.
Fig. 6.—Taking out two kernels from each ear and placing them on the

table in front of the ear from which they were taken, germ side up. Do not pick the ears off the table to remove the kernels; let them remain on the table so that you can use both hands, and there will be less danger of misplacing the ears.

Secret of Arranging Samples for Judging. A well-lighted room should always be provided for the corn exhibits. I cannot emphasize this too strongly. There should also be provided plenty of tables. Planks or boards laid over barrels or boxes will answer the purpose very well.

The samples in each class should be laid out side by side with a little space between them. The ears are held in place by nails driven into the table. (See fig. 5.)

Two or three kernels are now taken out of each ear and laid on the table in front of the ear, germ or heart side up. (See fig. 6.)

The samples are now ready for the judge.

When the judge has completed the judging he will fill out the entry tag as shown in figs. 3 and 4. The tag will show the exhibitor where his sample was most deficient and the rank or place given it in the class. In this particular case it shows that the sample was very immature and chaffy as it was marked on ripeness but sixteen out of the twenty-five points given for maturity and that he got third place.

The Real Purpose of the Show is Education.—The management of the show, the judge and the exhibitors should not lose sight of the real purpose of a show, viz., education. A show is a failure unless the exhibitors and people of the community learn how to grow more and better corn.

Selecting Seed Corn

Explanation and Illustration of the Points to be Studied

Fig. 1.—The frontispiece shows a Grand Champion ear of Reid's Yellow Dent corn. It is one of the best, if not the best, all-round ear of corn ever exhibited. It was grown by D. L. Pascal, of DeWitt, Iowa. Ten and one-quarter inches long; seven and seven-eighths inches circumference two inches from butt; six and seven-eighths inches circumference two inches from tip; weight nineteen ounces.

Size of Ears. A good sized ear is essential to a good yield. It indicates that the ear comes from a strong, vigorous, healthy stalk and that in turn it will produce stalks and ears having a strong constitution and hardiness. No one would think of selecting for seed small, weak, puny-looking ears. Corn has been bred for the grain or ear until the proportion of corn to stalk is abnormally high and consequently the tendency is for the ear to become smaller unless we select larger ears than we expect in the average of the crop.

On the other hand, the greater danger lies in selecting too large ears and too large types of corn, and this is especially true of the northern half of the corn belt. For every dollar lost by growing corn that is too small or too early there are ten to twenty dollars lost from growing corn that is too large and too late in maturing. If the season is late and cold, or the frosts come too early, or if the seed is planted late in the spring, the grower has a lot of soft, chaffy, moldy, light corn. In addition to this it is very difficult to secure good seed from such corn for next year's crop. It is certain to be more or less frozen, moldy and weak, and to result in a poor stand and a poor crop. Large, sappy,

immature ears fill the wagon-box rapidly, and we deceive ourselves into thinking that we are getting a large yield. Corn of this kind often contains from thirty-five to forty-five per cent. of water. When the corn dries it is loose on the cob, chaffy and light. The little cells in the kernels are only partially filled with food and are dull and chalky, or starchy, instead of bright, hard, heavy and rich in appearance. The corn is apt to spoil, especially in the bottom of the crib, i. e., burns out, and it is unpalatable to stock. The grower of such corn is required to sell at a greatly reduced price. What we want is corn that will be safe every year. Remember that two small ears weighing but ten ounces each, to each hill will make sixty-four bushels per acre, or double the average yield. Three of them will give nearly 100 bushels per acre.

Solidity or Heaviness. This indicates full maturity, good quality, feeding value and yield.

Uniformity in Size and Shape of Both Ears and Kernels. Many exhibitors and corn growers fail fully to realize the importance of selecting ears of uniform size and shape. Large ears will generally have larger and deeper kernels. Short, bunchy ears are certain to have deeper kernels than long, slim ears. As a consequence the planter cannot be adjusted to give a uniform drop.

If we have large and small ears, bunchy and slim ears, deep kerneled and shallow kerneled ears we shall not only have unevenness in size and shape of kernels, but we shall also have a great variation in time of maturity, some stalks bearing early and some late, and some having high ears and some low.

Kernels of the same ear will not mature at the same time, and some will turn black and moldy. These late, sappy kernels are likely to be injured by freezing.

Unevenness in size and shape of ears and kernels is an indication that the corn has not been improved, that is, it is not well bred.

It will seldom prove profitable to mix different varieties of corn. Not only shall we have all of the objections which have been mentioned above, but there will be a tendency to deterioration; the crossed or mixed corn not yielding as much as either of the varieties crossed.

Fig. 2

Fig. 2.—(*g*) is germ or heart of the kernel; (*f p*) is the white, floury, starchy looking material in the center of the kernel; (*h p*) is the hard, horny portion.

The composition of these parts is approximately as follows:

	Per cent. oil	Per cent. protein.	Per cent. ash.	Total
Germ or heart ..	50.	20.	10.	80.
Horny portion ..	.5	10.	.5	11.
White, floury ..	.3	8.	.5	8.8

This shows that the heart of the kernel is by far the richest part. Eighty per cent. of it being composed of oil, protein and ash, the most valuable food constituents. The white, floury looking portion is the poorest part of the kernel, containing but 8.8 per cent. of the oil, protein and ash. It will readily be seen that the larger the germ or heart and the smaller the floury looking portion, the richer will be the corn. We do not need a chemist to show us the richest ears; we can determine it by examining the kernels.

The Germ, Chit or Heart of the Kernel. The germs should be large, clean, clear and bright. The germ is much richer in oil, ash and protein than the

rest of the kernel, therefore, it should be large, giving us stronger germination and more vigorous plants in the field.

Be suspicious of a shriveled, wrinkled or blistered germ. In examining corn the germ should be opened up with the knife. This will enable one to determine, not only the size of the germ, but its condition. If it is pasty or salvy, or is yellow or black, the vitality is very questionable. When possible, the germination or vitality should be determined by actually sprouting six kernels taken from different parts of each ear.

Depth of Kernels. Other things being equal the deeper the kernels the greater will be the per cent. of corn to the cob and the greater the yield. It is therefore desirable to have a good depth of kernel on an ear, but since it is so, there is danger of overdoing it. There is much greater loss from selecting ears with too much depth of kernels than ears with kernels too shallow.

The objections to too deep kernels are: 1. Their immaturity, sappiness, chaffiness, mold, etc., resulting in poor quality and low, actual yield from the feeding standpoint. 2. They contain more moisture than shallow kernels, are slow in drying out and consequently the seed is more likely to freeze or mold and to give a poor stand the following year, which means a less yield. 3. The planter is made to handle the average length of kernels and will not give an even drop if they are abnormally deep. Experience shows that on an average we are much more likely to have a thin stand from deep kernels than from medium depth kernels, due, first, to weakness of seed; and, second, to difficulty in securing an even drop.

Sappiness, Chaffiness, Starchiness, etc. These are all indications of immaturity and lead us to be suspicious, also, of the vitality.

A sappy ear is one which contains a large amount of water. It is shown by heaviness of ear, softness of grain and cob, and the ease with which the ear may be twisted in the hands. When the sappy ear dries out, the kernels are shriveled or shrunken and become loose on the cob. We call such an ear chaffy. When the kernels in such an ear, instead of being clear, bright, hard and horny are dull, soft and whitish or chalky in appearance, we call the ear starchy. In all of these cases it is apparent that the corn did not have time fully to develop. Either it was too large and too late for the region, or it was planted out of season or harvested too early in the fall. For the first reason it should be discriminated against much more strongly than for the second, especially from the standpoint of seed selection.

When we say an ear is "mature," "well ripened," etc., we mean that the thousands of little cells in the kernels are completely filled, i. e., packed full of food for the future plant when the seed germinates. Immaturity means that the process by which the cells were filled was stopped too soon.

Every feeder of experience fights shy of immature corn, because animals will not consume enough to make satisfactory gains. When it molds in the field or crib, as it does more or less, it is unpalatable and unhealthy.

Corn put into the crib in the fall in a sappy condition freezes and thaws repeatedly through the winter. In March and April when the weather warms up, it will be found that the hearts of the kernels have turned to a cheesy color and later become black and are strong to the taste. In this last case I have reference not to soft, immature corn, but to what would be considered as very good corn except that it is large and contains considerable water.

The real significance of the matter will be better understood when it is realized that the germ or heart of the kernel is by far the richest part of the corn for feed.

Shape of Ear. In general the ear should conform to the variety type. For example, we would expect the Reid's Yellow Dent and Legal Tender varieties to be longer in proportion to their circumference than the Silver King or Boone Co. White. We would expect the Leaming to taper more toward the tip of the ear than the Boone Co. White or Silver Mine. We often overlook the fact that when we attempt to change the shape of the ears there are certain other things which are bound to follow. For example, if we select ears that are cylindrical, i. e., ears that are as large at the tips as at the butt, the ears within a few years will become shorter, larger around, later in maturity, higher on the stalk; the kernels larger, deeper and rougher; the stalks larger and the leaves thicker and broader.

Many breeders and exhibitors have injured their corn by selecting ears nearly as large at the tip as at the butt. On the other hand, if the ears taper too much the corn becomes flinty, the kernels shallow and small toward the tip of the ear. If we select long ears our corn will gradually become earlier, the kernels broader, shallower and harder, with furrows between the rows. The stalks will become smaller, the leaves narrower and the ears lower on the stalk. We should bear in mind that when we undertake to bring about by selection some one particular thing desired that we also secure a number of other things some of which may be very detrimental.

Climate, soil and the use to which the crop is put are also important factors to be considered in determining the type of ear to be selected. As we go north with a variety we should select ears that are more slender, and that have smoother, shallower kernels and wider furrows.

As we go south we should select larger ears, fuller in the middle, with deeper kernels and a rough dent.

In like manner a rich soil and higher altitude require, for best results, a larger ear than thin, poor soils and lower altitude. In the South a hard, flinty corn resists the weevil better than the larger, soft kerneled types.

Where corn is grown largely for the total feed value of the grain and stalks, i. e., where it is cut and shocked or put in the silo, much less attention need be given to large shanks and big butts. The fact is, these things tend to carry with them sturdiness, vigor and heavy foliage.

It is well for us to remember that when we get a small butt, shank and cob in an ear, we are bound to suffer, in other directions, more or less, for what we have gained, especially if we go to the extreme. The stalk will correlate itself with these characteristics and become slender, weaker and more likely to break over with the wind; the foliage will be scarcer and paler and there will be a general weakening in constitution.

Fig. 3. Space Between Kernels.—Space between kernels next to the cob is objectionable because it results in less proportion of corn to the cob, poorer feed value and weaker stalks and lower yield. It is also an indication of immaturity. These two ears are almost exactly the same size and shape, yet No. 2 shelled out thirty-three per cent. more corn than No. 1, and the corn was cleaner, brighter and more solid. The right-hand row of kernels is from ear No. 1 with space at cob. The left row of kernels is from ear No. 2 which shows no space. Compare No. 4 with No. 3 and No. 6 with No. 5 and notice the

difference in plumpness of tips of kernels. Judging from outward appearances alone these two ears presented an equally good appearance. It is not enough to study the ear only; we must study the kernels, also.

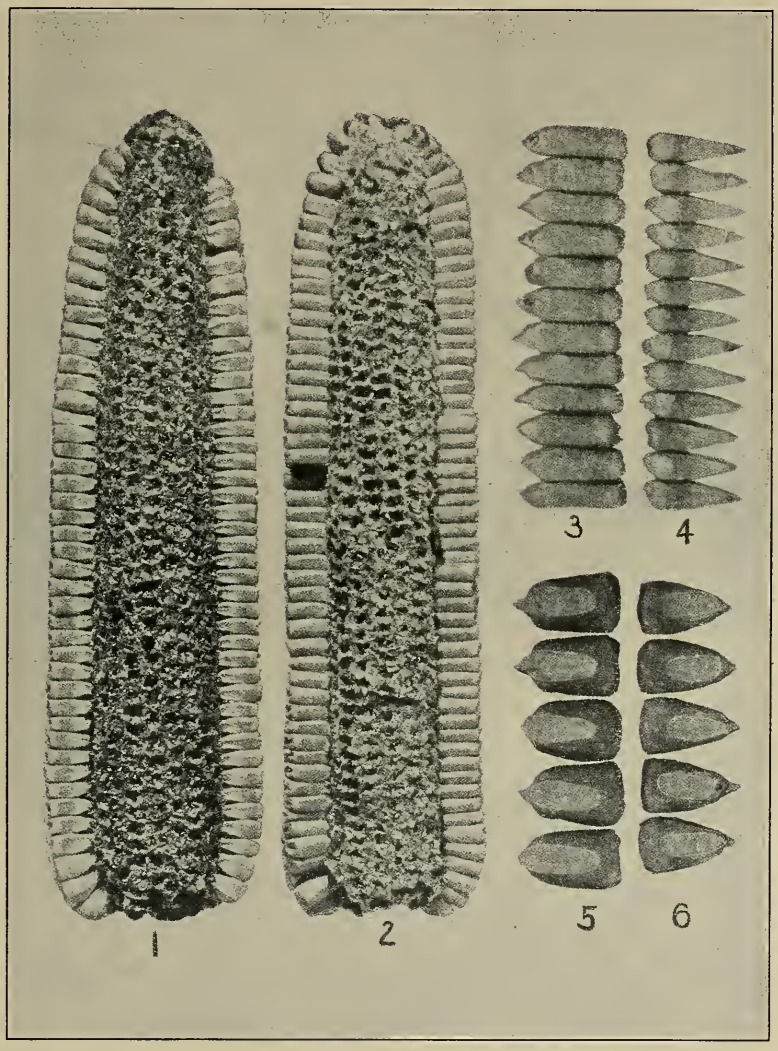


Fig. 3

Plumpness of Tips of Kernels. It is always advisable that the kernels of an ear should have plump, bright, clean tips, which indicate good constitution, maturity and feeding value as well as a high percentage of corn to the cob.

Fig. 4. Pairs of Kernels From Different Ears. Kernels Should be Uniform in Size and Shape.—It will also be observed that these kernels are far from uniform in size and shape (compare Nos. 4, 5 and 6) and hence no planter

will drop an even number per hill. When we realize that all of these kernels were taken from ears that appeared to be good, when examined from the standpoint of the ear alone, we can readily appreciate the importance of paying more attention to the study of the kernels of corn in our seed ears. The shapes best for the corn belt will vary with different varieties and with the purpose for which the corn is grown, but there is a tendency toward a uniformity of shape and type of kernels for the general field crop. Such type and shape are shown best by pairs of kernels Nos. 1, 6, 7 and 12 in order named. For late planting or early feed, types like Nos. 11 and 3 are better. No. 12 has full plump tips, early clean germs and bright horny kernels. Nos. 4, 8 and 10 show the poorest shapes of kernels. It is more difficult to mature an ear with this shape of kernel than one of the same size having kernels like No. 12.

Fig. 4

Uniformity in Size and Shape of Kernels. In selecting ears for seed or for show, much attention should be paid to picking those with kernels of uniform size and shape.

1. The kernels should be uniform on the different parts of the ear, i. e., they should not be broad and thin on one side and of the shoe-peg type on the other. They should not be thick, coarse and deep at one end, and small and round and shallow toward the other. Ears with irregular kernels commonly called "nigger heads," caused by the dropping of rows, by imperfect pollenizing or by crooked rows, should be laid aside for other ears providing these are as good in other respects.

2. In length, breadth and depth of the kernels the different ears should be as nearly alike as possible. This is necessary if we are to secure an even stand and uniformity in essential characteristics.

The particular size and shape of kernels will necessarily depend on the variety of corn grown, the length of season and the use to which the crop is put.

Filling the Butts and Tips of Ears. Other things being equal, a well filled butt and tip are desirable. They give us just that much more corn and indicate that the corn has been well bred for a number of years. We must not, however, make the mistake as some do, of sacrificing yields and other qualities to this one thing. It is valuable just to the extent that it gives us more corn.

The well-filled tips and butts are apt to occur on rather short ears; therefore, unless we are on guard, we will unconsciously shorten the ears, and in this way lose more than we gain by adding a few more kernels to the tip and butt.

The question should always be, Is this ear as good in all other respects? If so, choose it in preference.

Furrows Between the Rows. These will vary with the latitude and with the variety. In the northern part of the corn belt it is necessary to grow varieties with fewer rows, and shallower and broader kernels. These are always accompanied with a pronounced opening or furrow between the rows.

Character of Dent. The character of the dent has much to do with the appearance of corn. It is one of the important characteristics in distinguishing varieties. While there are all gradations of dent, yet the common designations are smooth, medium rough, rough and chaffy. The tendency is for corn to become smoother on thin soils, in the shorter seasons of the north, and as the elevation is increased. Generally speaking roughness is associated with lateness, and smoothness with earliness; again, roughness is always associated with deep kernels, and smoothness with shallow kernels. There has been a tendency toward a deeper kernel, and as a consequence some of our varieties have become later, more immature, lighter and of poorer quality.

Purity of Color in Both Grain and Cob. The color of the kernels and of the cob should correspond to the variety represented.

Smoothness of Backs of Kernels. The blistering of the back of a kernel indicates that it did not dry out properly or was frozen while still sappy. In either case there is danger that the germ is weakened or killed.

Smoothness of Germ. The puffing or wrinkling of the face of the germ may indicate freezing or improper drying and should lead to a careful examination of the germ and especially of the embryo.

Adherence of Chaff to Tip Cap of Kernel. Frequently some of the chaff of the cob will adhere to the tip cap of the kernel. This is generally an indication that the ear was more or less immature when harvested. It occurs oftenest on rough, deep kerneled ears. It suggests that the ear was a little too late for the region. When shelled such corn appears dull and chaffy, instead of clean, bright and sound, and of course there is more danger that it has been injured by mold or freezing.

Adherence of Tip Cap of Kernel to the Cob. This is similar to the condition just described above, except that the tip cap of the kernel breaks off in the cob. When the corn matures naturally the kernels will separate from the cob at the proper place, leaving the chaff attached to the cob and the tip cap to the kernel, as it should be.

The Cob, Its Size and Condition. The cob should be light, bright in color, soft, not harsh or woody, and free from mold. A large swollen butt and a projecting shank where the ear was broken off at the time of husking are objectionable.

Both of these conditions indicate lack of breeding, shallow and irregular kernels and a low proportion of corn to the cob. Ears with large butts and large shank attachments are hard to husk and slow in drying out. The shank should break off close in at the butt of the ear instead of leaving an inch or two protruding from the butt.

Straight Rows. Straight rows are preferable to crooked rows. Ears with twisting rows are certain to have more or less irregular kernels and to show inferiority in many other ways.

Fig. 5. Grand Champion Dam and Five of its Progeny. Exhibited by Earl Zeller, Cooper, Iowa, in Iowa Junior Contest, 1910.—From the corn shelled off the mother ear at the left and planted, Earl Zeller was able in the fall to select these five sample ears. It is seldom that so many good seed

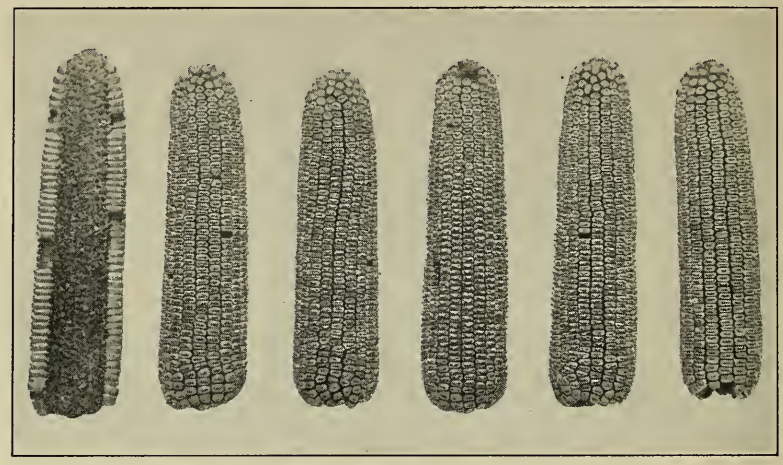


Fig. 5

ears can be obtained from the planting of a dozen ears. We have not yet learned the value of good ears of corn, ones which will produce results in yield and quality.

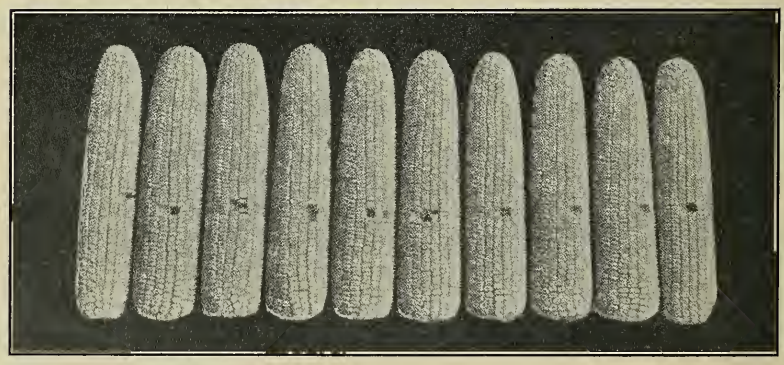


Fig. 6

Fig. 6. Grand Champion Ten Ears.—Variety Johnson County White. Exhibited by R. B. Clore, National corn show, Omaha, 1910. Bought by Successful Farming for $335.00. This is undoubtedly one of the ten best ears ever exhibited at a show. This is too large a variety for the northern half of the corn belt.

Fig. 7. Boone Co. White.—Grand Champion ten ears. Junior show, Ames, 1910, exhibited by Bernard Haggland, Assex, Iowa.

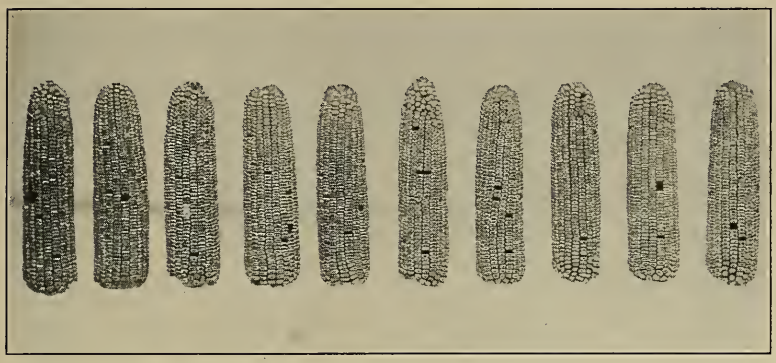


Fig. 7

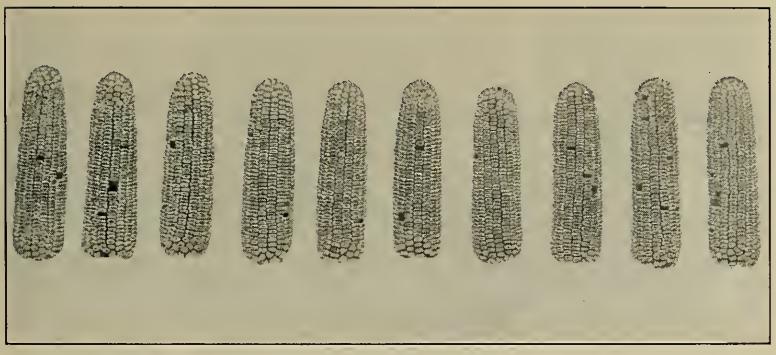


Fig. 8

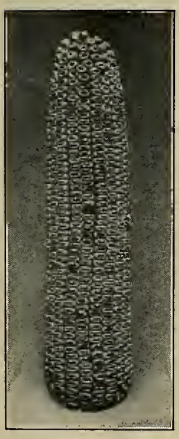


Fig. 9

Fig. 8. Silver King. — Sweepstakes for North Central section of Iowa Junior corn show at Ames, 1910. Exhibited by Marian George, West Union, Iowa.

Fig. 9. Grand Champion. — Junior show 1910, exhibited by Orville Garrett. This is a typical Reid's Yellow Dent ear of fine quality and strong constitution.

Fig. 10.—This is a remarkably fine ear of corn. "Like tends to produce like."

Fig. 11. — Illustrates good forms of ears. All are well proportioned, have good butts and tips, the rows are straight and the kernels uniform. All of the ears show strength, constitution and good breeding. Ears Nos. 1, 3 and 4 would plant well together.

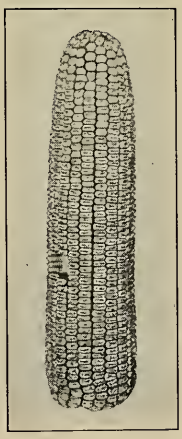


Fig. 10

Ear No. 4 is too blunt at the tip. Ears Nos. 2 and 3 have a proper taper to the tip. A thick tip leads to shorter ears, later maturity and deeper kernels.

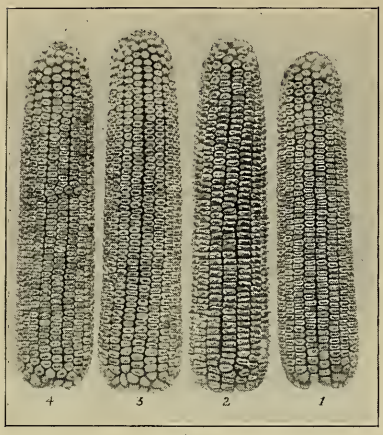


Fig. 11

Fig. 12. Space Between Rows. —Study these ears carefully. Ear No. 3 has about the right amount of space between the rows to insure best results, while ears Nos. 1 and 4 illustrate the extreme. Ear No 1 has too much space, showing a deterioration or "run out" appearance, and it will shell out a low per cent. of corn to the cob. On the other hand, where there is too little space between the rows, as in the case of No. 4, the ear generally presents a dull, starchy or immature appearance. The kernels are too pointed or wedge like, leaving a great deal of open space next to the cob, and are lacking in vitality. Ear No. 2 has a little too much space, while there is perhaps not quite enough on ear No. 5.

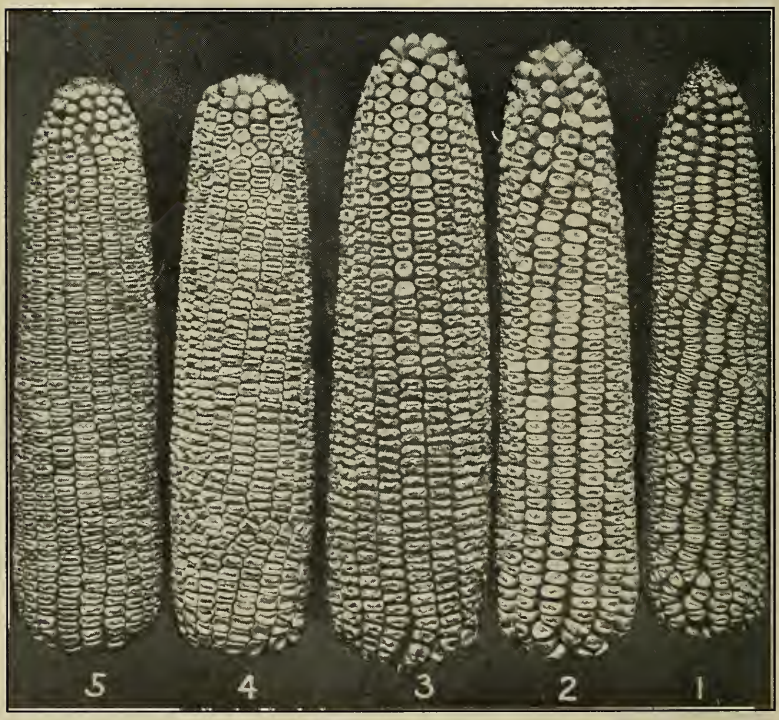


Fig. 12

Fig. 13. Irregular Kernels.—In selecting seed ears Nos. 2 and 3 should be discarded as no planter will drop a uniform number of these kernels per hill.

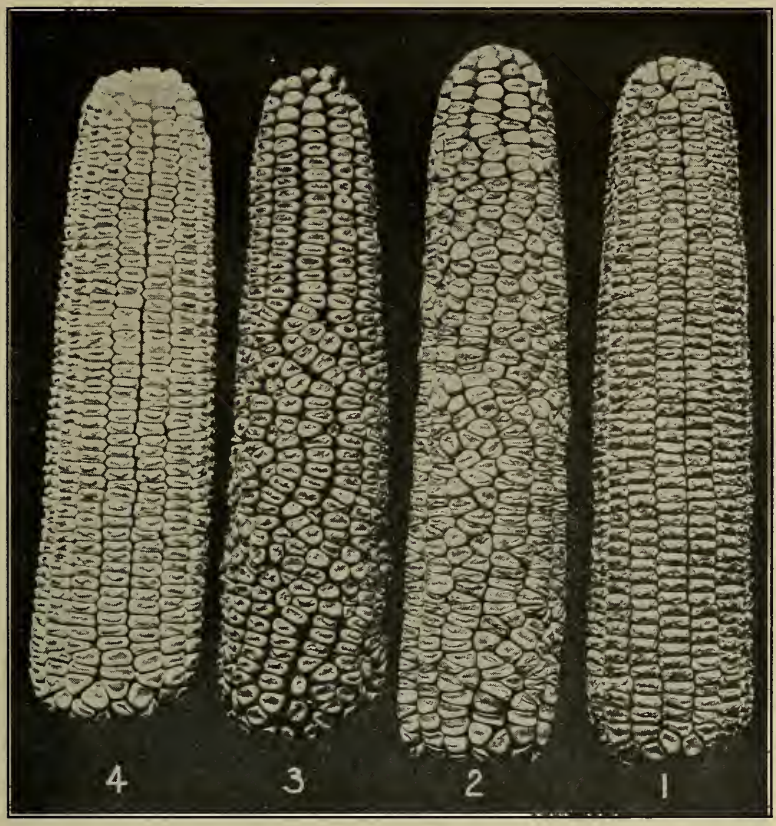


Fig. 13

Ears Nos. 1 and 4 have kernels of uniform size and shape, and when the butts and tips were shelled off the planter dropped three kernels to a hill in

4 3 Fig. 14 2 1

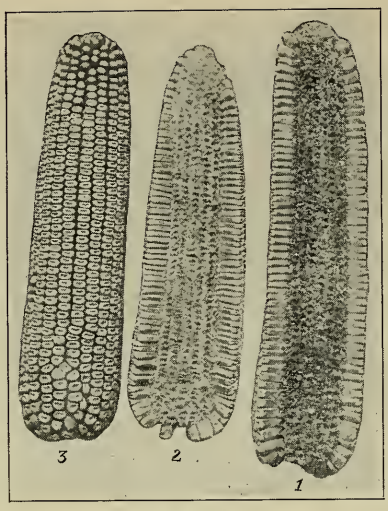


Fig. 15

ninety-three to ninety-five times out of every 100 tests, while ear No. 2 tested 74-3s, 19-2s, 6-1s and 1-5s.

Fig. 14. Cross Section of Ears. —Nos. 1 and 3 have about the right proportion of corn to the cob. In the case of No. 2 the cob is too small and in time the constitution and yield will suffer. The cob in No. 4 is too large.

Fig. 15. Study the Seed Ears.— Don't guess, when a little examination will reveal the strength and weakness of the ears.

Ear No. 1 is strong, sound, has good kernels with fair depth, which it carries well down to the butt of the ear.

Ear No. 2 tapers too much. The kernels are too deep at the butt, and too shallow toward the tip, making them too uneven for the planter.

Ear No. 3 has small, shallow,

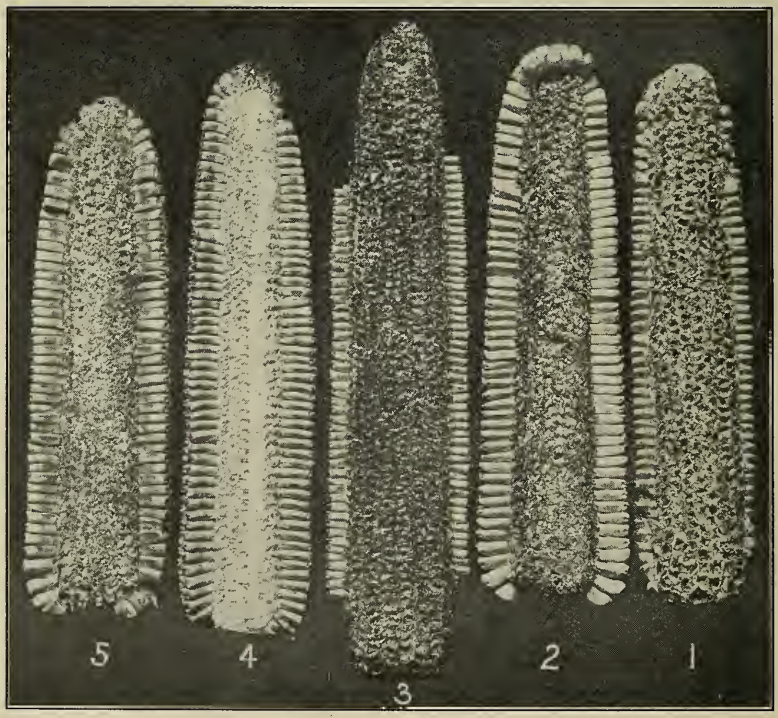


Fig. 16

flinty kernels, but little larger than the kernels of pop-corn, which will run through the planter too fast.

These three ears were shelled together and tested in the planter. The number of kernels dropped per hill ranged from two to seven.

Fig. 16. Desirable and Undesirable Ears.—Note carefully the difference in these ears. Ears Nos. 2 and 5 have kernels of fair depth, which they carry as well as they should down to the tip of the ears. Ear No. 4 has a deep kernel but becomes too shallow at the tip of the ear, and there is some space between the kernels next to the cob and the kernels are too thin for good constitution. Ears Nos. 1 and 3 have shallow, low kernels and should be discarded. Until the kernels were well examined the real weakness of these ears was not discovered. The casual observer would have pronounced all of these ears good from general appearance.

Fig. 17

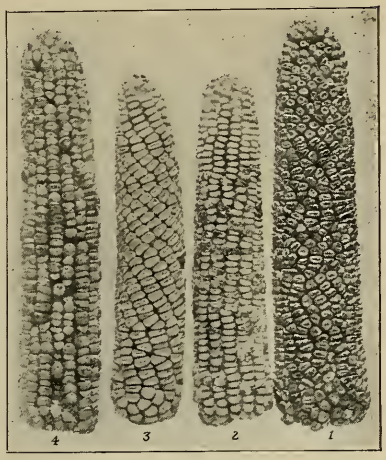


Fig. 18

Fig. 17. Scrubs or Degenerates.—They are always most numerous when conditions are unfavorable, such as poor ground, late planting, poor cultivation, careless selection of seed, etc. If you will notice carefully you will observe the peculiarly beaked appearance at the front part of the crown of the kernels on ears Nos. 4 and 5. These points, where the silks attached, are almost needle-like in their sharpness. This is a sign of degeneracy wherever found. It generally appears on ears which show many other signs of degeneracy.

Fig. 18. More Degenerates.—What a contrast to the prize winning ears. No one would think of planting these ears, but they illustrate what happens, more or less, in every corn-field but especially where we have a mixture of different kinds of types of corn.

Ear No. 1 is faulty, particularly because of the irregular rows and consequent irregular kernels.

Ear No. 2 shows the result of mixture of early and late types. If you will notice carefully you will see many broken or ruptured kernels. These kernels inherited the late characteristics of one of the parents and were soft when other kernels hardened and crowded them. The crowns broke open, and many of them have become affected and are rotten and moldy.

Ear No. 4 was too late. By the time its silks were pushed out the pollen was gone, and the only fertilization it received was from the old and weak grains of pollen which blew off the leaves and tassels where it had lodged.

Fig. 19.—Ear No. 2 has 540 kernels while No. 3 has 1140, or double the number on ear No. 2.

These ears were picked from the seed ears which were being shelled together for planting. When the man was shown these three ears, and asked if he thought the planter would give an even drop with such wide variation in kernels, he said, "Well, I hadn't thought of that; they looked like good ears and I put them in." And so they were good ears in themselves.

When these ears were shelled separately and tested in the planter, No. 2 dropped 158 kernels in 100 drops, while ear No. 3 dropped 387 kernels in 100 drops or checks. But this is not the only disadvantage; the yield and quality of the crop will be affected in other ways. There will be immature, moldy, and frozen corn, high ears and low ears, ears hard to husk and ears easy to husk, etc.

If this man had laid out his ears intended for seed side by side on the table and removed two kernels from each ear, the variation would have been apparent. The trouble was that he looked at each ear separately and without any relation to the other.

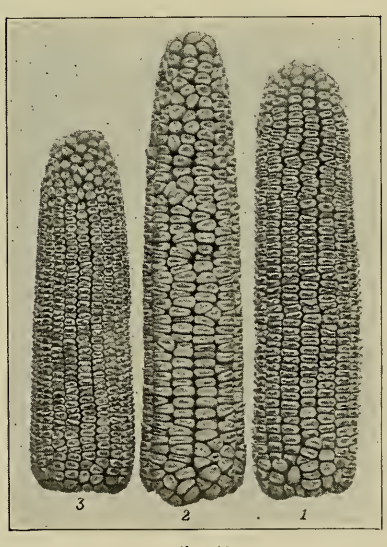


Fig. 19

Fig. 20

Fig. 20. Broken Kernels.—Notice that many of the tips of the kernels (lower one-third) remained attached to the cob. Generally only a portion of the kernels on an ear are affected. A careful examination will show that the rows of kernels in the spots affected are slightly raised above the others. Ordinarily, this condition will not be detected until kernels are removed for study, or the ear is shelled. It is probably caused by a disease in connection with the silks, which sometimes lie between the rows of kernels as they develop. If ears are shelled separately such ears can be discarded. It is not enough to simply discard the kernels affected.

Fig. 21. The Backs of the Kernels (side opposite germ).—Examine the backs of the kernels, for weakness and strength are often revealed there. Nos. 7, 6, 14 and 13 are the strongest kernels here. They are clean, bright and horny. The only objection to Nos. 14 and 13 is that the tips of the kernels

Fig. 21

have a little too long projection. Nos. 5, 6 and 4 are even more objectionable in this respect. It interferes with the drop. The kernel is really larger than it appears. Nos. 11 and 12 are too pointed and shriveled at the tips. They indicate lack of constitution. Nos. 12 and 10 show a whitish or chalky color,

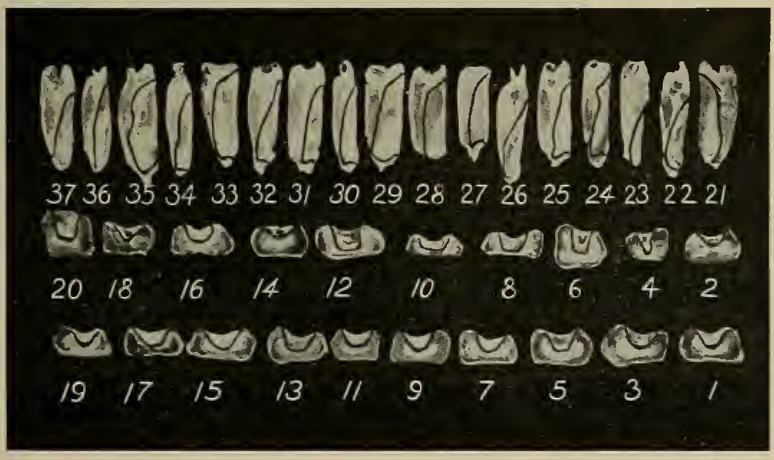


Fig. 22

which shows that the ears did not mature. Such corn is poor in quality and will reproduce after its kind. Nos. 8 and 9, kernels cracked or broken one-third of the way to crown.

Fig. 22. How to Pick Out the Ear with Rich Kernels.—The *best* 100 *ears*, discussed in the chapter on "Preparing the Corn for the Planter" (see fig. 10, p. 14 "hanging up the seed") should have large, deep germs.

In preparing the seed corn for the planter in the spring, two or three kernels are taken from each ear and laid on the table, germ side up, in front of their respective ears. You will notice that some of these kernels will have broad germs, others will have narrow germs. In some cases the germ will run well to the crown of the kernel, etc. We should not stop by simply examining the length and breadth of the germ on the face of the kernel, we should split the kernel open with a knife lengthwise through the germ, to determine the thickness or depth as well.

Nos. 21 to 37 show the kernels split open, half of the kernels being removed. Note the great variation in depth of germ. Nos. 35, 33, 29, 28, 27 and 21 are deep germs, No. 35 being from the ear richest in oil and protein of the 1400 ears analyzed. Nos. 22, 23, 26, 31 and 32 were especially poor.

Fig. 23

The two lower rows show the cross section of the kernels, i. e., the tip of the kernels being cut off showing the depth and width of germ. Nos. 2, 4 and 14 have either narrow or shallow germs. Nos. 12, 16, 13, 15 and 17 show good size of germ.

Figs. 23 and 24.—Cross section of kernel showing depth and width of germ.

Fig. 25.—In No. 1 the kernels show chaffy portion of cob adhering to them. It gives a bad appearance to the corn and indicates immaturity. No. 2 shows kernels that are cracked about one-

Fig. 24

Fig. 25

third of the way from tip to crown being injured by some disease. This condition may not be observed until the ear is shelled. Although only a portion of the kernels on an ear is affected, the whole ear should be discarded to

prevent the continuation of the weakness. If each ear is shelled separately, as it should be, this can be done easily. In No. 3 the tip cap has too long a projection which interferes with planting. These kernels also show a whitish or starchy appearance toward the tip, indicating that the ear did not fully ripen. No. 4 shows kernels with tip cap projecting, the germ having broken off in shelling. While this is not a serious defect, it shows that the ear did not ripen completely.

Of the five pairs of kernels in the lower row, No. 5 is the most desirable. Pairs of kernels Nos. 8, 9, 12 and 13 are also desirable, showing a combination of good depth, large clean germs and good maturity. Nos. 10, 11, 6 and 7 are less desirable.

Fig. 26

Fig. 26.—Kernels showing large and small germs, taken from different ears of corn. The left-hand kernels in all pairs came from ears with low feeding value and should be discarded for seed purposes; while the right hand kernels

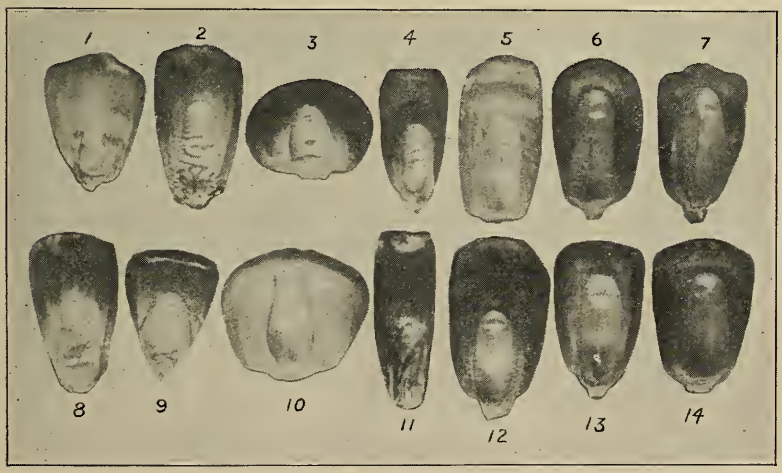


Fig. 27

with large germs came from ears with a high per cent. of oil, protein and ash and give strong plants.

Fig. 27. Type of Kernels.—Nos. 1, 2, 3, 4, 8, 9 and 11 are illustrations of kernels with small, weak germs. Note how small the germs are compared with Nos. 6, 7, 13 and 14. Nos. 8 and 9 have poor shaped kernels; this coupled with their small germs, make them very undesirable. Pointed kernels such as these do not give room for good development of the germ. In addition to being pointed, these kernels are very thin at the tips, and so are weaker than they appear. Kernels of this shape frequently break off in shelling, especially if immature. No. 2 has a shrunken, blistered germ owing to its immaturity, but it is of better form than Nos. 1, 8 or 9. Ears with pointed kernels give a very low percentage of corn to cob, as the wedge-like shape of the kernels does not allow them to fit closely at the tips next to the cob. Nos. 3 and 10 are types of very broad, shallow kernels such as are grown in the north where the season is short and where deep kernels could not mature. Kernels Nos. 5 and 12 have germs rather under the medium size, but are particularly weak at the crown. They do not carry their width up well like Nos. 13 and 14. They are thin at the crown, giving the ear a chaffy appearance. Of the remaining four No. 14 is the best, followed by Nos. 6, 13 and 7 in the order named. These four are particularly good kernels for the corn belt, they carry their width well down to the tip, have large, plump tips and large, clean germs. The general appearance of the kernels indicates strength and vitality.

A Study of the Stalk

Characteristics of Roots, Foliage, Husk and Tassel of Great Importance

The character of the stalk should be taken into consideration in selecting the seed.

There are almost as many things to be considered in connection with the stalk as have been discussed with regard to the ear; though it will be impossible to give to the subject the space it deserves.

There are the root system; the character of the foliage, and its distribution on the stalk; the disposition to sucker and to set several ears; the length of the shank, the time of pollenation as compared with silking; susceptibility to disease such as rust, smut and mold; tendency to break over at the roots, below the ear and above the ear; premature ripening, leaving the ear light and chaffy; the position of the ear on the stalk, high, medium or low; erect or drooping; the way the ear is covered with the husks and the comparative maturity of the different stalks and ears, etc.

The great majority of corn raisers do not take these things into consideration. They simply save the occasional good ear throughout the husking season or pick them from the crib at planting time.

We must know the stalk upon which the ear grew, whether the stalk was the only one in the hill or one of three stalks.

How is this to be done? There is just one practical way to do it, and that is to go into the field in the fall, before the nights are cold enough to injure the vitality of the corn, and select the best ears, provided they come from strong, healthy, desirable stalks. We simply must come to this method of selecting our seed corn.

Strong Stalks. The stock from which an ear is selected should be strong, vigorous and healthy, indicating ability to win in the competition and to overcome unfavorable conditions. We should discriminate against spindling

stalks, especially those that are small from the ear to the ground. Particularly should we avoid those stalks which have shown their weakness by breaking over. The ear is likely to rest on the ground and gather moisture and mold. Though the ear may not rest on the ground it will not dry out, as the wind cannot get to it. Such an ear may be sound and all right this year, but it will transmit its weakness if we use it for seed.

Height of Ear. Select ears from as nearly the same height and position on the stalk as possible. The higher growing ears will tend to make the corn later each year, and with this lateness will come larger ears, more rows and deeper kernels and finally sappiness, chaffiness, poor quality, frozen or moldy corn. Such stalks are more likely to break over in the wind.

If we go to the other extreme we will soon get an early, small, slim, flinty ear with shallow kernels and open furrows between the rows and the yield will be reduced. Or, if we select without any regard to height of ear, we will have a mixture of large and small ears, of deep and shallow kernels, of soft ears and flinty ears, which, in some respects at least, is worse than either extreme.

Drooping or Erect Ears. An ear that droops its nose slightly as the husk begins to turn yellow and open is preferable to one that stands erect allowing the water to run down under the husks and stand at the butt of the ear, which of course is undesirable. The drooping ears are generally a little earlier than the erect ones. If you have a variety in which the ears mostly stand erect in ripening time, it is better that the husks should be long enough to cover the tip of the ear and remain pretty well closed to prevent the water from running down under the cover next to the ear.

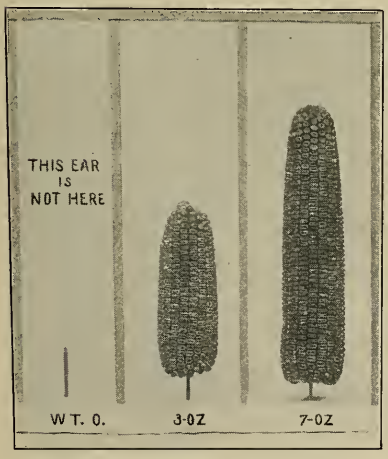


Fig. 1

Fig. 2

Short Shank Desirable. The ear should be set on a short shank close to the stalk. Ears on long shanks are more likely to be broken off and are a nuisance to handle especially if the corn is cut and shocked. Of more consequence, however, is the fact that it indicates a tendency to reversion and degeneracy.

Freedom From Disease. The stalks should be free from disease such as smut, rust, mold, etc. The corn from some ears is much more susceptible to disease than that from others. Anyone who will plant say, 50 or 100 ears, each in a separate row side by side, will notice at harvest time that some of these rows are badly affected by smut or rust and sometimes with mold, while the adjoining rows may not show a single case of disease on any of the 800 stalks. I have seen cases where nearly every stalk coming from a certain ear was affected, and so badly affected that there was not a good ear on any of the 800 stalks.

If you have never given this matter any attention you will hardly notice the rusty stalks. The leaves will show hundreds of small faded spots. These will be better seen if you hold the leaf up to the light and look through it. You may also frequently notice a moldy appearance on the shank or at the joints often extending to the ear. These are things that are worth taking into consideration.

Fig. 3

Fig. 4

The Foliage, its Character and Distribution. A thin, sparse foliage is never desirable. It carries with it nothing but weakness. In the corn belt where the ear is the most valuable part of the plant, we should secure the kind of stalk and foliage which will give the greatest profit in grain. This will not

be secured by a dense, heavy foliage. The best results will be between the two extremes. The leaves should not be thin, pale and papery but reasonably broad, thick, dark green and not whipped to shreds by the wind. The lower leaves should not be too much dried up and the stalk should not be prematurely ripened, as this means weak and inferior ears.

If the corn is grown for the fodder as well as for the ear, and is to be shocked or siloed, then the selection should be for an abundance of heavy dark-green foliage, with leaves broad, thick, leathery and green to the ground.

Sometimes a large proportion of the foliage is above the ear, in which case the wind is apt to break the stalk over. There are other disadvantages such as lateness, etc. Neither should all of the foliage be beneath the ear, but fairly well distributed, with the greater part below.

Fig. 5

Fig. 6

Tendency to Sucker. The tendency to much suckering is undesirable and greatly reduces the yield. There are several causes which tend to increase

suckering. Rich ground with excessive plant food, wet seasons, thin stand. Suckers rob other plants of space, light, moisture and plant food and give in return little but fodder. The few nubbins which they produce are soft and reduce the quality of the crop. Even when corn is grown for fodder, suckering is not desirable. It indicates a tendency to revert to its native condition. When ears are planted in separate rows it is observed that some of the rows will have many suckers while others may be entirely or nearly free from them.

The flint corns and the dent varieties grown in the northern outskirts of the corn belt show a strong tendency to sucker. Pulling the suckers is often impracticable. The thing to do is to select seed from the stalks that are free from suckers.

Two Ears to the Stalk not Desirable. Except possibly in the case of flint varieties and the early northern dent varieties which are grown for the fodder it will be advisable to select seed from one-ear stalks. If we attempt to secure two ears to the stalk, we will greatly reduce the quality. The ears will be small and the second one to set will be soft and imperfectly pollinated.

Fig. 7

Covering of the Ear With Husks. A heavy mass of husks on an ear or the projection of the husks beyond the tip of the ear into a tight point are objectionable, they prevent the corn from drying and make it more difficult to husk. The husks should just fairly cover the tip of the ear and should loosen or open at time of ripening to allow circulation of air in order to dry out the corn.

Lice. Lice on the husks will cause the shucks to turn yellow prematurely. In selecting seed do not mistake this yellow condition for early ripening.

Figs. 1 and 2.—The product of the average hill of corn in the corn belt equals thirty-two bushels per acre. We plant three kernels and harvest what is equal to one ten ounce ear, or one small ear weighing seven ounces and a nubbin weighing three ounces.

Fig. 3. Uniformity of Height Desirable.—The height of ears will vary with different varieties, soils, and latitudes, but it should be uniform as shown by these excellent hills. If every hill produced two ears such as hill No. 1, the yield would be ninety-three bushels per acre, or nearly three times the present average of the corn belt. If each hill produced three ears such as No. 2, the yield would be 120 bushels or nearly four times the average.

Fig. 4.—We should know the stalk from which our seed ears are picked. Here are three hills of corn each with two stalks. It is apparent that the

height of the two ears in each hill must be due to inheritance, since it could not be due to difference in soil or treatment, for these were necessarily the same. With different heights of ear are associated many other diversities, which are objectionable, such as difference in time of ripening, depth of kernels, shape of ear, etc.

Fig. 5. Stalks Fooling Around all Summer Doing Nothing.—Barren stalks and weak ones are the cause of great losses in every field. Where corn is grown almost wholly for the grain, these barren stalks are not simply so much loss, they are worse than worthless, for they not only deprive the good stalks of light, moisture and food, but they produce millions of grains of pollen to fertilize the silks of good ears and so propagate their kind for the future. Four of the five stalks in these two hills are barren. Notice their weak appearance. They were weak when they came up, they were weak when they first sprouted. Many of these weak stalks can be eliminated by testing each ear and discarding those with weak germination.

Fig. 6. Inheritance. Three Stalks From One Hill.—Stalk No. 3 is barren. Stalk No. 1 bore two ears which weighed one and one-half pounds equal to seventy-six bushels per acre. Stalk No. 3 is large and strong, but why barren? It inherited this tendency from some of its parents.

Fig. 7. Strong and Weak Stalks.—No. 1 is a good stalk; the ear is set just a little low. No. 2 has long joints, scant foliage and ear too near the tassel.

The Secret of Breeding

Improvement by Selection, Heredity and Variation

Importance. The success of every enterprise is dependent either directly or indirectly upon the crops of the farm, and here it is that the great advancements in the future are to be made, first, by producing larger yields of better quality; and, second, by a better use of the crops produced. The larger yields will be brought about, first, by better methods of cultivation; and, second, by breeding up or improving our crops so that with a certain amount of labor the greatest possible yield of the best quality can be produced.

How to Improve. Improvement will be brought about (1) by securing the varieties or strains best adapted to the local conditions and purposes.

2. By selecting the best individuals of the variety and breeding from them. This work will be accomplished largely through the efforts of the seedsmen, the experiment stations, the farmers and individuals who will take up plant breeding as a matter of interest and pleasure.

Begin With the Best. The most important step in improvement is to secure at the outset that variety which under the best conditions will give the greatest yield of the best quality for the purpose desired. The difference in yield between different varieties or types is much greater than is generally supposed. Too often years are spent in trying to improve some inferior variety when there is something better right at hand.

If every farmer could secure the particular variety of corn best adapted to his local conditions, it would undoubtedly increase the average yield more than five bushels per acre, thereby adding many millions of dollars annually to the wealth of the country.

In 1903, the Iowa Experiment Station secured seed corn from forty-one different farmers in the state, care being taken to secure seed from the stock intended to be used by the farmers in planting their own fields. The samples were planted, three kernels per hill by hand, and they received exactly the same treatment throughout the season.

A careful study of the plots was made after the corn had matured. Three stalks per hill were considered a perfect stand. The important facts brought about by this experiment were:

1. The low vitality of the seed, the average stand of the thirty-six varieties being sixty-seven per cent. Some of the samples gave as low as ten, twelve, fifteen and twenty per cent. of a stand. Only seven samples gave about eighty-four per cent. and five other samples gave between eighty and eighty-five per cent., leaving twenty-four of the thirty-six samples with less than eighty per cent. of a stand. In other words, it required 100 acres of land and labor to secure sixty-seven acres of corn. This tremendous loss can be greatly reduced if the methods described in this book are followed.

2. The wide range in yield, from less than eight bushels to more than ninety-one bushels per acre. This was partly due to the poor stand, but we must remember that this was the seed that the farmer himself was going to plant in his own field and he could not reasonably hope for a better stand than was secured in this experiment.

3. One of the most important facts brought out by this experiment is the wide differences in the yield between the different kinds of corn obtained from the different farmers where the stands were practically the same. Take for example samples Nos. 1 and 2, both of which were from Dallas County but from different farmers. No. 1 yielded 54.73 bushels per acre, while No. 2 yielded 67.63 bushels or thirteen bushels more than No. 1. Sample No. 16 with eighty-two per cent. of a stand yielded sixty-six and one-quarter bushels, while sample No. 6 with seventy-eight per cent. of a stand yielded ninety-one and one-half bushels, or a difference of twenty-five bushels per acre. Samples Nos. 9 and 10 from Plymouth and Calhoun Counties, with practically the same stand, gave a difference of twenty bushels per acre. Many other illustrations could be given, all tending to show the difference in producing power of the different kinds of corn under otherwise similar conditions.

4. A study of the varieties showed a great variation in the time of ripening, methods of growth, number of barren, broken and smutty stalks, in the height of the ears, amount of foliage, etc.

Help Needed. How then is the farmer or breeder to find out which variety is best for his particular conditions? How is he to find who, among the hundreds and thousands of his neighbor farmers, have quietly but effectually through years of careful selection built up a new strain of some of the best varieties until it will outyield anything else in that particular region?

What Seedsmen Can Do. Seedsmen have done much to introduce profitable varieties and they can do a great deal more along this line. Often the farmer finds that the new variety purchased is greatly inferior to the variety which he has been growing; in fact, this has generally proved to be so. It is a practice too common among seedsmen to exaggerate greatly the merits of their different seeds, much to the injury of their own business and to the hurt of the agricultural interests of the county. The method of some seedsmen of thoroughly testing some new variety or strain in their trial grounds before advertising it, is highly to be commended.

Looking to Experiment Stations. The experiment stations in the different states are testing the most promising varieties and publishing the results, thus rendering valuable service. Some of the stations have gone further and are

trying to find out what varieties are the best adapted to the different soils and sections of their state.

Government Aid Necessary. This work can be carried on extensively enough to be helpful only by government aid, hence it is right that experiment stations be established and maintained since every interest in the state is as much dependent upon the crops of the farm as is the farmer himself. If left to the individual nearly all merely experimental work will necessarily be left undone.

County Experiment Stations. Every county should maintain a county experiment station where different varieties of grains, forage and other plants can be grown to determine which are best suited to the soil and climate of that county.

Crosses Unstable. The results of crosses are often very encouraging at first, but as the years go by, hope gives place to disappointment, for the breeder sees his plants gradually deteriorating or reverting.

Many illustrations could be given bearing out the above. Fortunately, however, this is not always the case and many of our best varieties, especially in horticulture, are the results of crosses.

Why Crops Run Out. The question is often raised as to whether crops "run out" or not. To say that crops do not "run out" would be to deny that any variations are produced by changed conditions or environment. When plants are brought into new conditions of soil, climate, or methods of farming less favorable, they will tend to deteriorate or "run out."

Desirable Qualities Suffer First Under Unfavorable Conditions. If corn is planted too thick (seven or eight stalks per hill) a large yield of foliage will be obtained, but the yield of grain will be small. Under unfavorable conditions the plant tends to revert to its original condition, and the particular thing for which the plant is grown and which gives it value suffers first and most.

Best Methods Necessary. It is only by the best methods of seed selection and of cultivation that the farmer can hope to maintain the valuable qualities of his crops, otherwise they will deteriorate or "run out" and it will be necessary for him to secure seed from some one who has paid more attention to the improvement of his crops.

The Secret of Planting

Time and Method of Seeding. Quantity of Seed. Garnering the Crop

Early Planting. While too early planting is not advisable, yet I am perfectly safe in saying that for every dollar lost by too early planting, there are twenty dollars lost from planting too late.

The advantages of reasonably early planting are: The assurance of better yields, better quality, and a better condition of ground; while there is less risk from frost in the fall, less danger of the freezing of seed before it is dried out and from spoiling in crib. Also there is time to replant in case of a poor stand due to any cause such as poor seed, too deep planting, injury from insects, etc.

Hills Better Than Drills. Generally, it is best to plant in hills. Repeated experiments show that there is no difference in yield of grain between the two methods of planting where the same amount of seed is used and the corn is kept equally clean; but it is more difficult to keep the drilled corn free from weeds under the average conditions and as a consequence the yield is more or less reduced. If there is any advantage from distributing the stalks in the case of drills, it is more than balanced by the better cultivation which the ground receives when the corn is planted in hills.

Corn may sometimes be drilled to advantage under the following conditions: When the field is narrow or irregular or full of obstacles, such as stumps; when fodder is the prime consideration; when the ground is sod and compara tively free from weeds, but badly infected with cutworms and other insects; or when listing is practiced.

Quantity of Seed to Plant. The number of kernels it is best to plant in each hill will depend on the strength or richness of the ground; type of corn—whether it is large or small; distance apart of rows and hills; latitude; the purpose for which the crop is grown; rainfall; and the vitality or germinating power of the seed.

Corn should be planted thicker on strong land than on thin ground. Thick planting on poor land results in a large amount of fodder or stover at the expense of grain. On the other hand, it is even a more serious mistake to plant too little seed on very rich ground for the plants will sucker badly, and give a large amount of fodder but a disappointing yield of corn. The small, early growing varieties should be planted thicker than the large, late growing kinds. In northern parts where smaller varieties are grown, more seed should be used than farther south. For example, it is customary to plant three and four kernels per hill (generally four), in Michigan, Wisconsin, Minnesota and South Dakota, while two and three are planted in Tennessee, Missouri and Kansas. Still farther south corn is planted in drills four feet apart and it is thinned down to one stalk every two or two and one-half feet in the drill. This would not be half the number of stalks required to give the best results in Iowa or the north two-thirds of Illinois. Experience shows that corn should be planted thinner where the average annual rainfall is light.

Corn is generally planted to-day in hills three and one-half feet apart each way. In some sections three feet eight inches is still the rule, but the tendency is toward three feet six inches as the standard. It is not settled that this is actually the best distance from the standpoint of yield, but taking the average of conditions it is probably not far from right.

There is a tendency on the part of the manufacturers of planters, check row wires and cultivators to adopt a standard which is largely determined by the demand, but when once established the disposition to change is slow.

Taking these standard distances of three feet six inches and three feet eight inches apart each way, what are the actual results year after year on different soils and in different localities, from planting different numbers of kernels per hill?

After making a careful study of this question for the past ten years, I believe I am safe in making the following statement. That there is much greater danger from a stand too thin than from one too thick.

Corn never thickens up. There is always a process of thinning out from the day it is planted until it is ripe. If we plant three and one-half kernels per hill, that is, three in one hill and four in the next, we will have at harvest an average of two and one-half stalks per hill. If we plant four we will come through with two and three-quarter stalks per hill. We make the mistake of thinking that if we plant three kernels we are getting three stalks per hill.

Results of Experiments on Number of Kernels to Hill. The following figures are worthy of careful study, since they are the most extensive ever conducted along this line.

These experiments have been carried on under the direction of the Iowa State College in co-operation with the supervisors and stewards of the county poor farms in various parts of the state, and have extended over a period of five years.

The ground was marked off in rows three feet six inches each way. The corn was planted by hand to insure the dropping of the required number of kernels in each hill. The first block was planted at the rate of one kernel per hill. The next at the rate of one and one-half kernels per hill, i. e., one kernel in the first, two in the next, one in the next, two in the next, and so on, making an average of one and one-half kernels per hill. The third block was planted two kernels per hill; the fourth block at the rate of two and one-half kernels per hill and so on up to five kernels per hill.

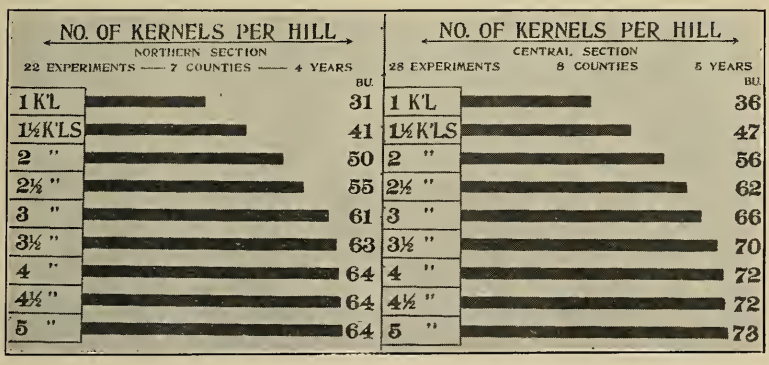
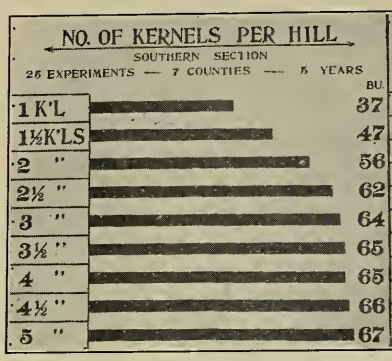


Fig. 1 Fig. 2

To insure accuracy the experiment was repeated again and still again so that there were three blocks with one kernel per hill, three with one and one-

half kernels per hill and so on. This was with one man's corn. To make the work still more dependable seed from a second man was planted in the



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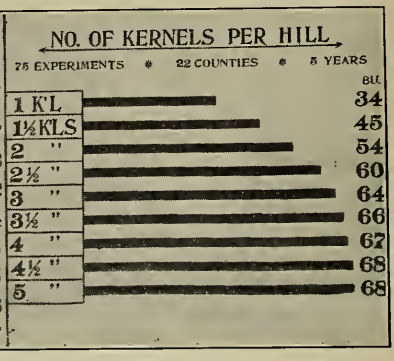

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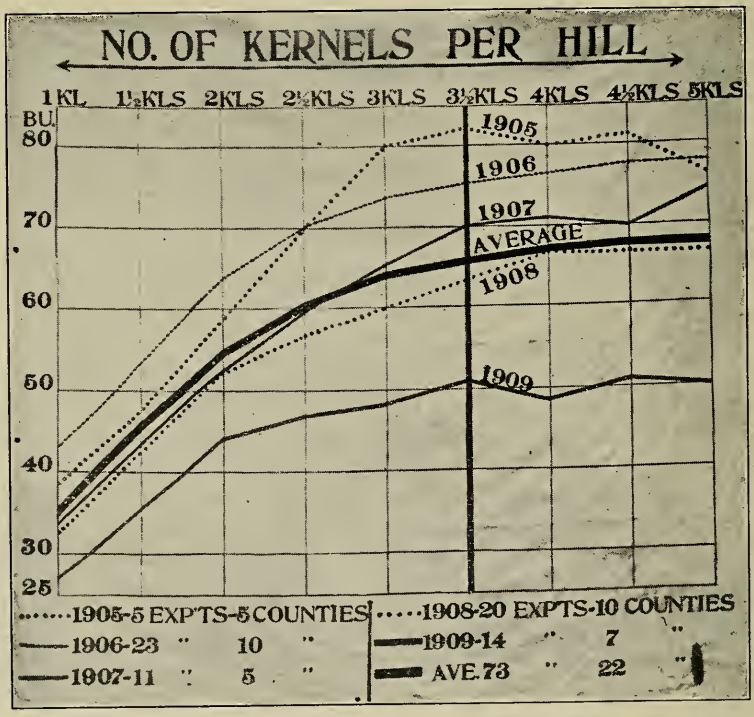

Fig. 5

same manner. Thus there were six blocks in different parts of the field planted with one kernel per hill, six planted with one and one-half kernels per hill, etc.

The seed was selected from farmers who lived in the county and was above the average of the locality in vitality, but it was the type or variety of corn commonly grown in that county. The planting, counting of the stand, harvesting and weighing was done by an assistant from the college.

Fig. 1.—Presents in a striking way the results of yields.
Fig. 2.—Summarizes the results of yields per acre in central section.
Fig. 3.—Summary of yields in southern section.
Fig. 4.—Average of all the experiments.
Fig. 5 shows a graphic summary of the results of planting different numbers of kernels per hill during different years.

Notice that in every one of the five years' experiments there was a rapid increase in yield up to three and one-half kernels per hill.

The heavy black line represents the average results of the entire five years' experiments. Notice that the yields in 1905 and 1909 did not increase where more than three and one-half kernels were planted, but that in an average of all the experiments there was a slight increase up to five kernels per hill.

Lessons From the Foregoing Tables. These summaries of the seventy-five experiments conducted in different portions of Iowa during the past five years showed:

1. That the danger lies in planting too little rather than too much seed. When we planted more seed than was necessary we did not reduce the yield, but when we planted less the yield fell off rapidly.

2. That in each section of the state, the yield increased rapidly up to three and one-half kernels per hill, but that beyond this number the increase was very slight.

3. That twenty-nine out of every 100 kernels planted in the spring, either failed to grow or were destroyed by insects or cultivation, leaving only seventy-one stalks at harvest time. This is the result of more than 3,000 tests in which the seed was gathered at planting time from the planter boxes in the field, so that it represented the actual corn planted by the farmer.

4. That the thin planting gave a large per cent. of suckers while from the thicker planting were produced more barren stalks.

5. The quality of the corn was not so good with the thin planting, due, first, to the fact that many stalks bore a second ear which was smaller, later and softer than the other; and, secondly, to similar ears borne by the suckers. There were more nubbins where the larger number of kernels were planted, but they were of better quality than the second ears and ears borne on the suckers in the case of thin planting.

Numerous experiments have been conducted in various parts of Illinois during the past fifteen years with results similar to those given above.

Let us not deceive ourselves by thinking that because we plant three kernels to the hill that we have three stalks per hill at harvest time.

Shrinkage of Corn in Crib. Many experiments have been conducted to determine the amount of loss from storage of ear corn in the crib. Perhaps the most extensive tests have been those conducted by Iowa and Illinois.

The shrinkage varies considerably with the different seasons, and with different varieties of corn.

The following table will show the per cent. shrinkage by months for eight different years at the Iowa Experiment Station at Ames:

MONTH	1898 1899	1899 1900	1900 1901	1902 1903	1903 1904	1904 1905	1905 1906	1906 1907	Aver- age	Mo. rate
November	8.1	4.0	2.6	1.8	8.2	8.3	7.2	1.4	5.2	5.2
December	8 9	2.6	3.6	3.6	10.9	9.5	9.2		6.9	1.7
January	9.0	2.3	4.6	5.7	11.7	10.2	9.0		7.5	.6
February	10.1	2.7	5.9	6.0	12.6	10.5	11.6	3.1	7.8	.3
March	10.3	4.4	6.8	9.2	14.9	15.3	12.0	4.5	9.7	1.9
April	14.6	6.6	8.6	15.3	19.3	15.4	15.1	7.1	12.8	3.1
May	15.0	7.4	11.4	15.1	24.3	19.0	17.5	8.2	14.7	1.9
June	16.0	8.0	12.4	21.4	26.0	19.8	19.1	7.6	16.3	1.6
July	17.7	7.4	15.9	22.5	26.7	20.2	19.5	8.2	17.3	1.0
August	18.0	7.1	15.0	22.6	29.5	21.2	18.7	8.6	17.8	.5
September	19.9	7.6	14.0	24.8	30.5	20.6	19.3	8.9	18.2	.4
October	19.7	7.9	13.6	24.9	30.0	20.8	19.3	9.5	18.2	.0

It will be seen that the total shrinkage for the year varied from a little less than eight per cent. in 1900 to thirty per cent. in 1904, the average for the eight years being a little over eighteen per cent.

The shrinkage would be somewhat greater than this under ordinary farm conditions as there would be some loss from rats, mice and birds, which could not occur in this case as the crib was screened with wire.

Note that the loss was generally greatest during November and the first part of December and again during the spring months of March, April and May, the average being over five per cent. in November and three per cent. in April.

"In 1893 a Farmers' Club in Pennsylvania adopted a resolution, asking the members to make a test and find out by actual weight how much corn would shrink or lose weight from husking time until the next June 1st. In accordance with that resolution, ten farmers reported that the shrinkage from November 1st to February 1st was eight and two-thirds per cent.; the shrinkage from February 1st to June 1st as eight per cent., or from husking time to June 1st next, sixteen and two-thirds per cent. The following year a similar test showed a shrinkage of 16.5 per cent." *

The Secrets of Cribbing Corn. We have become careless about cribbing corn. There is considerable loss every year from the heating and molding of corn in the crib and in such years as last, the loss was enormous. We have expanded our cribs from six to eight, ten and sometimes twelve feet in width, We have set them down close to the ground, made solid, tight floors and in many cases have boarded the double cribs up tight on the outside.

What corn needs when put in the cribs in November is the free circulation of air, the more the better. During the early part of the husking season corn contains from twenty to forty per cent. of moisture, but it must be dumped into the bottom of one of these cribs where there is little chance to dry out. More corn is shoveled in on top of it with more or less silks, husks and shelled corn.

Those who have observed closely will agree with me that this corn does not spoil in the fall or winter while the weather is cold, but that in the spring, during March and April, when the weather warms up and the germinating

*Bowman and Crossley's book on Corn, p. 209.

period approaches, the corn in the bottom of the crib begins to sweat and then to heat and mold. It "burns out," is light, the chit of the kernel is black and strong to the taste. Such corn is really of little value either for feed or for the market.

Our cribs should not be more than eight feet in width (better six feet), should not be boarded up tight on any side, should be higher from the ground and above all should have slat bottoms to admit air from below. By slat bottoms I mean 1x4 inch pieces set on edge one inch apart.

Where the first corn put into the crib is immature or sappy, it is a good plan to set some A shaped horses four to six feet long end to end lengthwise through the center of the crib. These should have strips of boards nailed on the sides sufficient to prevent the corn from filling in all of the space under the horses. This method will give circulation of air through the center of the bottom part of the crib where the corn most frequently spoils.

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